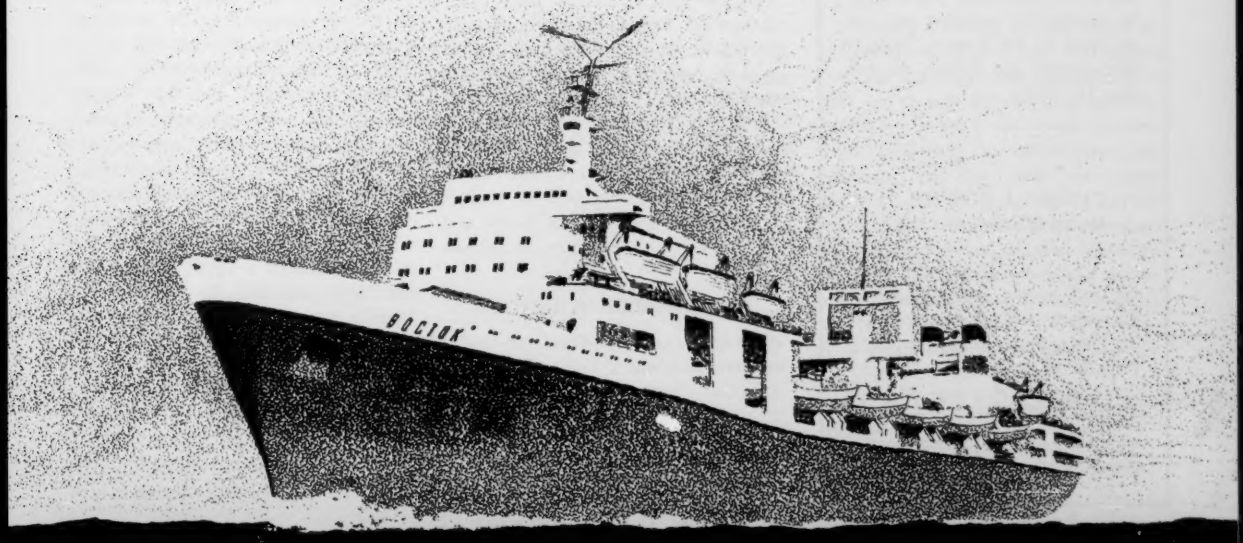
Volume 38 Number 12 December 1976

Marine Fisheries REVIEW

National Oceanic and Atmospheric Administration • National Marine Fisheries Service



U.S. DEPARTMENT OF COMMERCE
Elliot L. Richardson, Secretary

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
Robert M. White, Administrator

National Marine Fisheries Service
Robert W. Schoning, Director

Marine Fisheries Review is published monthly by NMFS Scientific Publications Staff, Room 450, 1107 N.E. 45th St., Seattle, WA 98105.

Publication of material from sources outside the Service is not an endorsement. The Service is not responsible for the accuracy of facts, views, or opinions of these sources.

Although the contents have not been copyrighted and may be reprinted freely, reference to source is appreciated.

The Secretary of Commerce has determined that the publication of this periodical is necessary in the transaction of public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director, Office of Management and Budget, through May 31, 1978.

Editor: J. D. Harrell
Managing Editor: W. Hobart

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Price $1.10 (single copy). Subscription price: $12.75 a year, $15.95 a year for foreign mailing. Controlled circulation postage paid at Seattle, Wash.

Marine Fisheries Review

Vol. 38, No. 12
December 1976

CONTENTS

Articles

1 Soviet Fisheries for Bottomfish and Herring off the Pacific and Bering Sea Coasts of the United States, A. T. Pruter

15 The Evolution of Fisheries Management Philosophy, Larry A. Nielsen

23 Foreign Direct Investment in the U.S. Commercial Fisheries Industry, Robert A. Siegel

Departments

26 NOAA/NMFS Developments

30 Foreign Fishery Developments

36 Index

Cover.—The *Vostok*, a four-deck, twin-screw mothership designed for tropical fishing operations is indicative of Russia's fisheries emphasis. A comprehensive look at the growth of Soviet fishing activities off the U. S. Pacific and Bering Sea coasts begins on page 1.

MFR PAPER 1225

Soviet Fisheries for Bottomfish and Herring off the Pacific and Bering Sea Coasts of the United States

A. T. PRUTER

INTRODUCTION

The signing by President Gerald Ford on 13 April 1976 of the Fishery Conservation and Management Act of 1976 has far-reaching implications for all nations which fish in waters off the United States. Under the terms of this Act, which will become effective on 1 March 1977, the United States will exercise exclusive management authority over all except highly migratory species of fish within a fishery conservation zone which extends 200 miles from shore.

The Act further provides for exclusive management authority over all continental shelf fishery resources beyond the fishery conservation zone and over all anadromous species of U.S. origin throughout their migratory range—except when they occur within another nation's territorial sea or fishery conservation zone. Impetus for the Act was a deep concern over the condition of fishery resources off the United States, many of which have been overfished and are in need of rebuilding, and the belief that the legislation is required to encourage the development of fisheries that are currently underutilized or not utilized by U.S. fishermen, including bottomfish off Alaska.

The Act prescribes certain requirements and conditions for domestic and foreign fisheries. Allocation of catches among foreign nations will be made only in excess of those capable of being harvested by U.S. fishermen. Such factors as the extent that the fishing vessels of each nation have traditionally fished within 200 miles of the United States will be considered—in addition to whether such nations have cooperated with the United States in enforcement and with respect to the conservation and management of fishery resources.

In view of these and other considerations, it seems appropriate to document the development and status of foreign fisheries off the United States. Such documentation may serve as an aid to those charged with developing fishery management plans relating to those nations which may apply to fish within the extended fisheries zone. This paper provides such documentation on Soviet fisheries for bottomfish and Pacific herring, *Clupea harengus pallasi*. Not discussed is the relatively small Soviet fishery for shrimp in the Gulf of Alaska, for which no Soviet catch was reported in 1975, or the fishery for crab in the eastern Bering Sea, which has not been carried out by the Soviets since 1971.

HISTORICAL PERSPECTIVE

Before describing contemporary Soviet fisheries it is useful to consider the evolution of that nation's fisheries. Fishing has always been an important source of food in Russia but was largely confined to rivers, lakes, and inland seas until recent times. Extension of marine fisheries from coastal waters of the USSR to ocean waters off other nations is almost entirely a post-World War II phenomenon.

The early historical pattern in Russia was to develop fisheries in lakes and rivers and then to move on to other lakes and rivers as the old ones came into full or over-production. By the 15th century all of the lakes and rivers of European Russia appear to have been fished, and the search for new fishing grounds was a factor in the opening of new Russian territories. By 1860 the total fish catch in Russia amounted to 320,000 metric tons; in 1913 it reached 1,050,000 tons, over 75 percent of which still came from inland waters.

Fisheries suffered severe setbacks during World War I and during the civil war. Catches fell to 893,000 tons in 1917 and to only 483,000 tons in 1922. Beginning in 1925, the Soviet government undertook to rehabilitate the fisheries, and by 1930 the catch reached 1,283,000 tons. As in earlier years, however, most of the production was still from inland waters. Although the emphasis gradually shifted to the ocean after 1930, most of the sea catch was from coastal waters. Deployment of a small fleet of trawlers to the

A. T. Pruter is with the Northwest Fisheries Center, National Marine Fisheries Service, NOAA, 2725 Montlake Blvd. East, Seattle, WA 98112.

Figure 1.—U.S. Coast Guard Cutter *Storis* with Soviet factoryship *Lamut* in custody. In foreground Soviet factoryship *50 Let Oktyabrya* moves by for a look. The *Lamut* was apprehended 17 January 1972 within the U.S. contiguous fishing zone off St. Matthew Island in the Bering Sea. Note ice in background.

Figure 2.—Factoryship *Arktika* with side trawler, *Lesh*, of SRT class alongside to unload catch taken off Kodiak Island in January 1973.

Barents Sea, with Murmansk as its base of operations, contributed to an increase in the sea catch in the 1930's.

Military operations and occupation of Soviet lands during World War II inflicted serious damage to Soviet fisheries. The catch in 1946 was only slightly larger than in 1913 and would have been smaller if steps had not been taken early in the war to accelerate the development of fisheries in the Soviet Far East.

Decisive measures were taken in the 1950's to expand all maritime activities, with early emphasis being given to developing a global fishing fleet. Growth of Soviet fishing power greatly influenced the international character of fisheries during the 1960's and served as a catalyst for other nations to undertake similar operations.

Expansion of ocean fishing after World War II was first to nearby waters of the Barents Sea, northeast Atlantic, Sea of Japan, Sea of Okhotsk, and to coastal waters of the western Bering Sea. A subsequent decline in stocks in those waters was compensated for by expansion of fishing to more distant waters. By 1964, fleets of the USSR were actively working virtually all of the North Atlantic fishing grounds, and operations also had been extended to the South Atlantic.

Expansion of Soviet Pacific fisheries occurred somewhat later than in the Atlantic, but once begun it was carried out at an even faster rate. Extension of fisheries in the eastern Pacific mostly has been to grounds off North America: to the Bering Sea in 1959; to the Gulf of Alaska in 1962; to the Aleutian Islands in 1963; and to waters off Washington, Oregon, and California in 1966. In recent years, grounds off the Pacific and Bering Sea coasts of the United States have accounted for a very significant part of the total fish harvest by the USSR; during the period 1970-74, they contributed 26 percent of the catch by the USSR from the entire Pacific Ocean and 10 percent of the catch from all marine waters.

Postwar expansion of Soviet fisheries was made possible by the construction of a large fleet of fishing and support vessels of standardized and proven design. Initial construction was largely contracted to shipyards in

western European nations because of their earlier experience with distant-water fisheries from which proven designs of vessels had evolved. These designs were judged by the Soviets to be good prototypes for their own use. As the USSR gained experience with its own distant-water fisheries and as facilities which had been destroyed or damaged in the war in the USSR and eastern European nations were rebuilt, the orders for ship construction were increasingly let to yards in Communist nations. Lessons learned by the Soviets from operating their own distant-water fisheries were incorporated into the design of the new vessels.

Use of large, factory stern trawlers became the dominant theme of the Soviet's distant-water fisheries. Although the concept of factory stern trawlers was developed by western European nations, the translation of the concept into the deployment of flotillas of such ships, working in close concert with support vessels, was mainly a Soviet achievement. Decision to speed up the construction of many factory stern trawlers, other kinds of catcher vessels and support vessels was reached in early 1956 by the 20th Congress of the Communist Party of the USSR. This decision was subsequently supported by the investment of over 10 billion rubles[1] in the fishing industry from 1956 to 1975. Over half was spent for new fishing and support vessels. As a consequence, the Soviet high seas fishing fleet is now the largest in the world, comprising over 5,400 distant-water vessels and accounting for at least half of the world's total gross tonnage for vessels of this size and type.

A substantial part of the Soviet investment in fisheries since World War II has been in the Far East region. Largest capital investments have been made in the Maritime Territory where the two ice-free ports of Vladivostok and Nahodka are located. They are major ports for the unloading of fish products, including catches from off the Pacific and Bering Sea coasts of the United States, and their transshipment to other parts of the USSR.

Pre-World War II catches in the Soviet Far East were mostly salmon, herring, and sardine, with lesser quantities of flounder and cod being taken from coastal waters. Sharp declines in the abundance of the coastal resources after the war stimulated an expansion of Soviet fishing operations to more distant fishing grounds in the North Pacific. This expansion, much of which was directed to grounds off the United States, was at least partially due to the depletion of fishery stocks in home waters. Depletion of local stocks of flounders was by overfishing, which also contributed to a decline in herring stocks. The decline in herring stocks was affected by Japanese as well as by Soviet fishing operations, and probably also by adverse environmental conditions which may have contributed to successively poor year classes.

In some ways, the growth of Soviet fisheries after World War II is an even more remarkable accomplishment than the resurgence of Japan's fisheries. Extension of Japan's fisheries was based on a long history of maritime activities in which ocean fisheries played an important role. The USSR had no comparable maritime legacy, and its prewar fisheries were almost entirely conducted in rivers, lakes, inland seas, or coastal waters. This not only meant that the Soviets had to train large numbers of fishermen and allied workers and make tremendous investments in vessels and shore facilities, but it also required that they develop a whole new deep-sea fishing tradition.

Growth of ocean fisheries was a reflection of a major Soviet commitment to raise the levels of all its maritime activities, including fisheries, merchant marine, and navy to major status among world powers. In pursuit of this objective, the ocean fisheries served as an important training ground for the merchant marine and navy. Total catch by the USSR in 1975 of all aquatic organisms, including plants and mammals, was 10.3 million metric

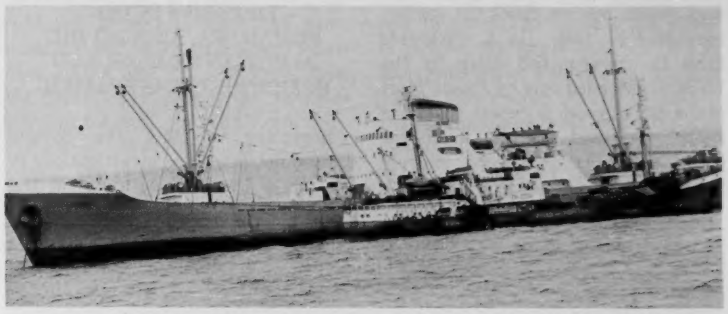


Figure 3.—Refrigerator transport *Kuloi* (Yana class), length overall 111 meters and crew of 61-63. Note side trawler of SRTM class alongside. A fishery support activity in the southeastern Bering Sea, January 1972.

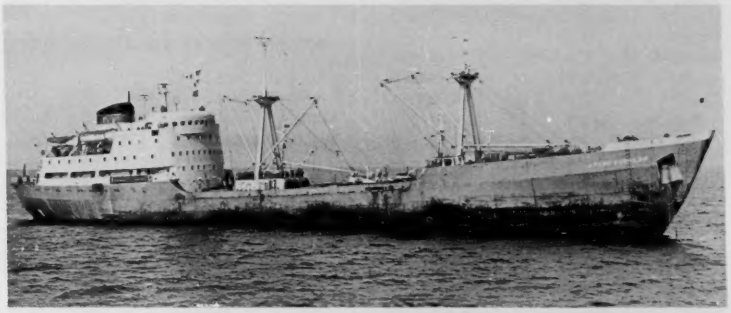


Figure 4.—Refrigerator transport, *Arkhip Kuindzhi* (Sibir class), length 130 meters, 6,100 gross tons. Anchored northwest of the Pribilof Islands in the Bering Sea, May 1966.

[1]The current rate of exchange is 1 ruble = $1.32 U.S.

tons, which was six times the amount harvested in 1950. On a worldwide basis the current fish catch by the USSR is exceeded only by Japan. Most of the Soviet catch in recent years has been from trawl fisheries in distant ocean waters which were entirely unknown to its prewar fishermen.

FISHERIES IN THE BERING SEA, AROUND THE ALEUTIAN ISLANDS, AND IN THE NORTHEAST PACIFIC

Beginning in 1958, the Soviets carried out extensive investigations in the North Pacific, with most of the effort being concentrated in the eastern Bering Sea. These were comprehensive studies and provided knowledge not only of the distribution and abundance of fisheries resources, but also much new information on water masses, currents, and the topography and geomorphology of the sea floor. As such, they were typical of the large-scale scientific support the Soviets characteristically have provided to the global expansion of their distant-water fisheries.

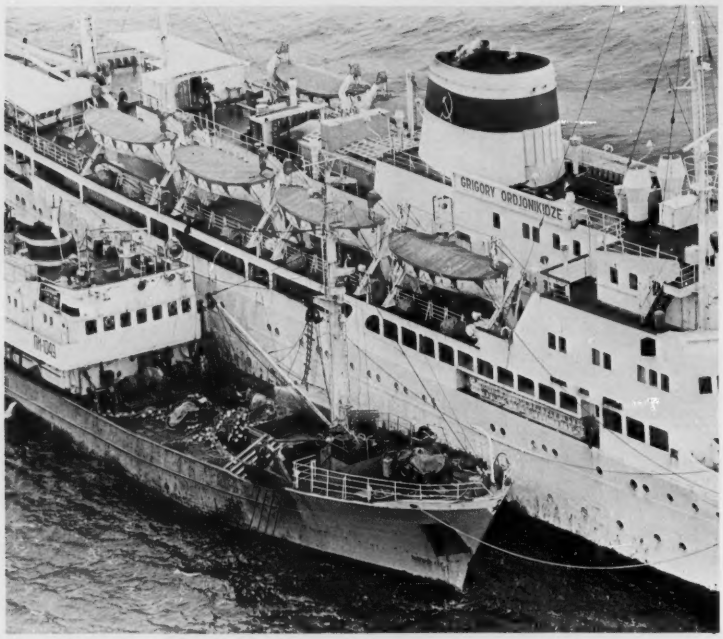


Figure 5.—Personnel transport *Grigory Ordzhonikidze* with side trawler *Lunnyi* of SRTM class nested alongside off Kodiak Island, February 1974.

Figure 6.—Small side trawler of SRT class engaged in fishery for Pacific hake off Oregon, July 1966. Note catch of hake in forward deck bins and fish strung up to dry aft of wheelhouse. Fenders of tires are used when alongside another vessel.

Soviet fishing vessels first appeared off Alaska in the eastern Bering Sea in 1959 and expanded their area of operations into the Gulf of Alaska and along the Aleutian Islands in 1962-63. By the end of 1963, Soviet fleets were carrying out year-round operations along much of Alaska's vast coastline for herring and a variety of species of bottomfish. A large-scale fishery for Pacific hake, *Merluccius productus*, was launched by the Soviets off Oregon and Washington in 1966. This fishery subsequently was extended to include waters off British Columbia and California and other species of bottomfish besides Pacific hake.

Types of Fishing Operations

Soviet fishing operations involve catcher vessels which deliver their catches to factoryships or to transports for processing or freezing, and vessels which process their own catches. Off the Pacific and Bering Sea coasts of the United States all the bottomfish and herring harvested by the USSR are caught with trawl gear. This is in contrast to Japan which, although relying most heavily upon trawl gear, also employs Danish seines and longlines for catching bottomfish and gill nets for catching herring.

The USSR, perhaps more than any other nation, relies on the expeditionary or flotilla concept in its fishing operations. This involves the deployment of a variety of vessels in close support of its catcher fleet. Support vessels include factoryships (Figs. 1

and 2) for receiving and processing catches, refrigerator transports (Figs. 3 and 4) to replenish stores aboard the catcher vessels and to receive, freeze, and transport their catches to the homeland, oil tankers, personnel transports (Fig. 5), tugs, patrol vessels and, occasionally, even hospital ships.

Refrigerator transports are the mainstay of the support operations and even receive and transport fish products from large factoryships instead of the factoryships delivering their products to home port. This practice permits the factoryships to remain on the fishing grounds longer, since they do not have to leave for home when their holds become full. The refrigerator transports are of varied sizes with some upwards of 200 meters in length and 25,000 gross tons or more. A large refrigerator transport of 25,000 gross tons has a hold capacity capable of storing about 12,000 tons of frozen products, which is equivalent to the capacity loads of about 13 of the factory stern trawlers now in use and the capacity loads of 6 to 8 of the new *Gorizont* and *Meridian* classes of factory stern trawlers which were recently scheduled for serial production.

The two basic kinds of fishing vessels that have been used by the Soviets are side trawlers and factory stern trawlers. Side trawlers shoot and haul their nets over the side of the vessel and are considerably smaller and less versatile than the factory trawlers which deploy their nets over the stern of the vessel.

Three classes of side trawlers have been used. Smallest and oldest of the side trawlers is the SRT class of 265-335 gross tons and a crew of 22-26 (Fig. 6). Next largest of the side trawlers is the SRTR class of refrigerated medium trawlers of 505-630 gross tons and a crew of 26-28. Largest of the refrigerated side trawlers is the SRTM class of around 700 gross tons with a crew of about 30 (Figs. 7 and 8). Side trawlers, particularly SRTM's, often operate independently by processing and freezing their own catches; however, they also may offload their catches to factoryships for processing or freezing. In recent years, a new class of stern ramp trawler, apparently designed as an improvement on the SRTM, has appeared on the fishing grounds off Alaska. These vessels, known as SRTK's (Fig. 9), are about 775 gross tons and reportedly have the same basic hull and general machinery below deck as the SRTM's, but above deck the SRTK's are redesigned for more efficient trawling over the stern.

Factory stern trawlers are the largest and increasingly common kind of catcher vessel employed by the Soviets. There are almost 800 factory stern trawlers in the Soviet worldwide fleet. Collectively, they account for over 15 percent by number and about 33 percent by gross tonnage of the Soviet high-seas fishing and support fleet. Factory stern trawlers typically process and freeze their own catches in contrast to the smaller side trawlers which often offload their catches to support vessels for processing and freezing. Because of their larger size and layout for handling the trawl net

Figure 7.—Side trawler *Sadgorod* of SRTM class on an exploratory fishing mission in the Bering Sea, February 1970.

Figure 8.—Side trawler *Kombainer* of SRTM class with catch of pollock and flatfishes taken off Kodiak Island, February 1974. Note several large Pacific halibut on deck just forward of winches.

Figure 9.—Stern-ramp trawler *Guberovi* (*Zheleznii Potok* class). A new class of SRTK's which reportedly have the same hull and machinery below deck as SRTM's, but above deck are redesigned for more efficient trawling over the stern.

Figure 10.—Factory stern trawler *Anisimovka* of BMRT class fishing off Icy Bay in the Gulf of Alaska, July 1975.

over the stern, factory stern trawlers are capable of fishing under worse weather conditions than side trawlers.

The most common factory stern trawler employed off the Pacific coast of the United States has been the so-called BMRT (Fig. 10) of 3,170 gross tons and a crew of about 90. A new class of factory stern trawlers, the RTM (Fig. 11), has come into increasing use. It is somewhat smaller than the BMRT but has the advantage of a larger deck area aft for handling gear and fish. The capacity of most presently used factory stern trawlers for storing frozen products is about 600 to 900 tons. The daily production capacity is generally 30 to 50 tons of frozen products plus 20 to 35 tons of waste products or nontarget species for processing into fish meal and oil. During good fishing periods for Pacific hake, a BMRT must resupply and offload its processed catch every 2 months or less.

The numbers of different Soviet catcher vessels which have operated off Alaska from 1963 to 1974 and off Washington, Oregon, and California from 1966 to 1975 are shown in Tables 1 and 2, respectively. While there has been a reduction in the total number of vessels operating off Washington, Oregon, and California, there has been no loss (actually, an increase) in the fishing power of the fleet because the number of large and more efficient factory stern trawlers has greatly increased. Off Alaska, the fishing power has increased even more. This is because factory stern trawlers now comprise over one-third of the fleet off Alaska—compared to about 9 percent of the fleet in 1963-65—and the small SRT's have been replaced with larger SRTM's and SRTK's in the Gulf of Alaska. The gross tonnages for the combined classes of vessels shown in Tables 1 and 2 are better measures of the fishing power than just numbers of vessels. As can be seen from the tables, the gross tonnage and, hence, relative fishing power of the Soviet fleet has greatly increased with time.

Economics of Fishing Operations

The fishing industry plays an essential role in the Soviet economy. It provides for around one-third of the national consumption of animal protein and is a large employer of human and other resources. The Soviet Government sets the amount of funds to be invested in the fishing industry, fixes production targets for the industry, determines salaries, and establishes prices for fishery products to be sold in domestic and foreign markets. The distant-water industry is managed by a large, centralized State administration and supported by educational establishments to provide a skilled work force. Research and development programs seek to find new fishery resources and to determine efficient ways to harvest and process them for human and industrial use.

An often-expressed view in the western world is that the Soviet fishing industry "does not have to make a profit." There is some support for this view in that the Soviet Government may, at times, heavily subsidize special fishing operations because of their exploratory nature or for strategic reasons. Losses may be deliberately written off for fishing in new areas or for previously unexploited species. Fishing operations have sometimes provided a useful cover for intelligence activities, and they also provide excellent training for sailors of the Russian Navy.

Although social and other aspects are considered along with profitability in judging the success or failure of fishing operations, the industry is subject to a form of "economic accounting." However, in this accounting system, the Soviet fishing industry enjoys several advantages over its capitalistic counterparts. Funds for capital investment are made available from the central budget as nonreturnable grants. Thus, loans do not have to be obtained for construction of vessels and equipment, and the costly interest payments so common in private enterprise are avoided. The price paid for fish by the Soviet consumer is set by the State, and the higher the price, the easier it is to show a profit. Information on fish prices in the USSR is scarce, but it seems that many species are relatively more expensive than in western European nations.

Although funds for capital investment in vessels and equipment are interest-free, the remainder of the Soviet financial structure resembles that of private enterprise fisheries. Each Soviet enterprise must pay for depreciation which, together with operating costs, is not expected to exceed income from the venture. This yardstick is sometimes applied to individual ships as well as to particular fisheries. Workers' pay may be by piecework or by standard rate with additional incentives in the form of extra pay for long service, overtime, overfulfillment of quotas, and regional rates for hardship service. The latter may be for voyages of long duration, services in particularly stormy areas, etc., and are not necessarily related to income from the sale of products. Another incentive for exceeding production norms is the so-called "socialist competition" which may be between individual vessels, fleets, or other units. Winners of such competitions receive special recognition and are held up for others to emulate.

An insight into the efficiency of Soviet operations may be gained by comparing them with Japanese operations. Particularly illuminating is a comparison of daily catch rates and the numbers of vessels employed in support of the catcher fleets. Both kinds of comparisons indicate that the Soviets

Figure 11.—Factory stern trawler *Polevod* of new RTM class. Vessels of the RTM class are somewhat smaller than BMRT's but have a larger deck area aft for handling gear and fish.

Table 1.—Number and equivalent gross registered tonnage of different Soviet catcher vessels sighted off Washington, Oregon, and California, 1966-75. Sightings were by NMFS personnel and do not include repeated sightings of the same vessels.

Year	Side trawlers				Factory stern trawlers			Equivalent gross tons, all classes
	SRT	SRTR	SRTM	Total	BMRT	RTM	Total	
1966	149	9	13	171	39	—	39	177,000
1967	—	—	—	[1]126	48	—	48	?
1968	24	—	14	38	56	—	56	194,000
1969	12	—	6	18	44	—	44	147,000
1970	—	—	8	8	55	—	55	180,000
1971	—	—	6	6	64	—	64	207,000
1972	2	—	3	5	42	2	44	141,000
1973	12	—	8	20	51	11	62	200,000
1974	—	—	—	—	78	16	94	290,000
1975	—	—	—	—	82	15	97	300,000

[1] Not differentiated by class in 1967.

Table 2.—Number and equivalent gross registered tonnage of different Soviet catcher vessels sighted off Alaska, 1963-74. Sightings were by NMFS personnel and do not include repeated sightings of the same vessels. Observations not extensive enough to provide comparative numbers in 1959-62 and unavailable for 1975.

Year	Side trawlers					Factory stern trawlers			Equivalent gross tons, all classes
	SRT	SRTR	SRTM	SRTK	Total	BMRT	RTM	Total	
1963	155	7	—	—	162	10	1	11	79,000
1964	237	9	12	—	258	28	1	29	167,000
1965	330	11	25	—	366	36	3	39	233,000
1966	248	9	44	—	301	42	4	46	245,000
1967	191	7	66	—	264	53	4	57	279,000
1968	97	5	90	—	192	71	3	74	324,000
1969	66	9	127	—	202	79	6	85	377,000
1970	65	11	144	—	220	97	6	103	447,000
1971	92	7	102	2	203	102	5	107	438,000
1972	111	6	161	7	285	100	11	111	497,000
1973	25	7	155	9	196	105	15	120	498,000
1974	25	7	174	8	214	117	14	131	546,000

are less efficient than their Japanese counterparts.

The extensive support in the form of factoryships, refrigerator transports, tugs, etc., provided by the Soviets to their catcher fleets accounts for up to 20 percent or more of the total man-days expended in the combined fleet operations for some target species. The extent of support activity is highest in the Bering Sea where many Soviet side trawlers deliver their catches to support vessels for processing, freezing, and transporting to the homeland. However, even in the hake fishery off the Pacific Northwest and California, where factory trawlers process and freeze their own catches, the man-days of effort expended by the Soviets for support activities is a significant part of the total. The man-days of effort expended by Japan on support vessel activities in fisheries off the Pacific coast of the United States is considerably less than that expended by the Soviets in otherwise comparable fisheries. On a worldwide basis, more than half of the gross tonnage of the Soviet distant-water fishing fleet reportedly consists of support vessels compared to less than 20 percent of the Japanese fleet.

There are two factors which seem to account largely for the greater reliance on support vessels by the Soviets. The USSR does not make as extensive use of foreign ports as does Japan for resupplying its catcher fleet or for offloading and transshipping the catches. Off the Pacific and Bering Sea coasts of the United States the important factor seems to be that the catches are not processed to the same extent on Soviet vessels as on Japanese vessels. Aboard Japanese vessels the catches are typically processed into "surimi" (minced flesh), fillets, and fish meal; a relatively small proportion of the catch is frozen in the round or in a headed and eviscerated form. On Soviet vessels a larger fraction of the catch is frozen in the round or as headed and eviscerated products. The more highly processed Japanese products occupy less space aboard the catcher vessels, which means they do not have to unload as frequently as Soviet vessels; hence, there is less need for refrigerator transports to be used in support of the Japanese fishing operations.

Perhaps the most meaningful indicator of the comparative efficiency of Soviet and Japanese fishing operations is the catch per vessel-day and catch per man-day. For vessels of similar types and sizes operating in the Bering Sea and Gulf of Alaska, the catch in weight of fish per Japanese vessel-day appears to be considerably higher than the catch per Soviet vessel-day, and the catch per man-day on Japanese vessels is proportionately even higher than on Soviet vessels. When allowance is made for the more extensive use of support vessels by the Soviets, the greater efficiency of the Japanese is rather striking.

Although it would be instructive to compare the monetary value of the catches produced per vessel-day and per man-day aboard Soviet and Japanese vessels, it has not been possible to do so because of a lack of data on amounts of different products (fish frozen in the round, fillets, minced fish flesh, fish meal, etc.) produced aboard Japanese and Soviet vessels and the dockside values of the products. Moreover, the dockside values are not directly comparable because in Japan they are set by a relatively free market whereas in the USSR they are set by the State. As noted above, however, the Japanese catches are processed into more finished products than the Soviet catches. For a given catch, the Japanese products, therefore, would be of higher value than the Soviet products, if they were sold in free competition with each other. Allowing for this factor further increases the efficiency of Japanese operations compared to Soviet operations.

Adequacy of Data

From 1959 when the Soviets began commercial operations off Alaska until 1964, no statistics were provided on catches except what can be inferred from scientific reports published on a few species. In 1964, the USSR began providing the Food and Agriculture Organization (FAO) of the United Nations with figures on catches of certain species in the eastern North Pacific. However, the catch area identified by the Soviets essentially included all fishing grounds in the eastern North Pacific between northern California (lat. 40° 30' N) and Cape Prince of Wales, Alaska (lat. 65°N), and offshore to long. 175°W, which in the north intercepts the Chukchi Peninsula of the Soviet Union at East Cape, just south of the Arctic Circle (FAO Statistical Area 67). Catches for such a huge area are of extremely limited value in assessing the impact of fishing on individual stocks of fish and shellfish which typically inhabit much smaller areas and is in stark contrast to the detailed statistics on catches which were published or otherwise made available by the United States, Canada, and Japan for those years.

As a result of a bilateral fisheries agreement concluded between the United States and the USSR, statistics on the fisheries of the two nations in the eastern North Pacific were exchanged beginning in 1967. However, for most of the period since 1967 the data provided by the Soviets have lacked detail on the area of capture and on the species harvested. The practice, until quite recently, was to provide data on catches of only a few primary target species and to combine the catches of all remaining species in a "miscellaneous" or "other species" category. On a few occasions this has led to the anomalous situation whereby the reported catch of miscellaneous or other species approached or even exceeded the reported catches of some of the target species.

Another problem in evaluating the impact of Soviet fisheries has been the difference sometimes occurring between the size of their reported catches and the quantities estimated by National Marine Fisheries Service (NMFS) personnel to have been caught while observing actual Soviet fishing operations from patrol aircraft and vessels. Such discrepancies between Soviet reports and observations by NMFS personnel also have occurred regarding the numbers and kinds of vessels involved in the fishing operations.

Perhaps the best-documented example of the above kind of problem occurred with the development by the Soviets of a new fishery for Alaska pollock, *Theragra chalcogramma*, and flounders near Kodiak Island in the Gulf of Alaska. The fishery began in January 1973 when elements of the

Soviet fleet, which formerly were assigned to fish for flounders in the eastern Bering Sea, were diverted to the Gulf of Alaska. The reported catch by the Soviets in this new fishery during January-April 1973 was 8,273 metric tons, compared to an estimated catch of 40,000 to 50,000 tons by NMFS personnel. According to observations by NMFS personnel, side trawlers accounted for almost one-half of the vessel-days of effort expended in this fishery, but the Soviets reported that no side trawlers were involved in fishing. After a series of discussions between United States and Soviet officials concerning this large disparity between observed and reported fishing, the Soviets provided United States scientists with a supplement, which showed an additional 7,000 metric tons of bottomfish as having been caught. However, this still left a shortage of at least 25,000 metric tons between the revised catch figure of 15,000 tons reported by the Soviets and the catch of 40,000 to 50,000 tons estimated by NMFS personnel.

While the foregoing is not typical, differences between reported and observed catches and vessel operations have been frequent enough to limit the usefulness of much of the data provided by the Soviets on their fishing operations off the Pacific and Bering Sea coasts of the United States. The Soviet reports sometimes seem to err in over-reporting of catches or fishing effort as well as in under-reporting. Therefore, I believe that the inaccuracies reflect a failure of the Soviets to establish an adequate reporting system and to hold the vessel captains and others accountable for conforming to the system, rather than any deliberate attempt at subterfuge. However, the end result is the same; namely, the official Soviet statistics on catches and fishing effort have been of limited value to United States investigators for assessing the impact of Soviet fisheries on stocks of fish off the Pacific coast of North America.

Species Harvested—Kinds, Amounts, and Areas of Capture

A perspective of Soviet fisheries is obtained by comparing their harvests with those of other nations from waters off the Pacific and Bering Sea coasts of the United States. Cumulative catches of bottomfish by all nations during 1954-74 amounted to over 22 million metric tons. Of this amount, Japan accounted for over 15 million tons (67 percent), the USSR nearly 6 million tons (25 percent), and the United States about 1½ million tons (6 percent). The remainder was accounted for by the Republic of Korea (South Korea), Peoples Republic of Poland, Democratic Republic of Germany (East Germany), Federal Republic of Germany (West Germany), Republic of China (Taiwan), and Canada.

Although vessels of Japan and the USSR have operated throughout the eastern Bering Sea, around the Aleutian Islands, in the Gulf of Alaska, and off the States of Washington, Oregon, and California, these areas have been of different relative importance to each nation. Over 90 percent of Japan's harvest of bottomfish has been from the Bering Sea compared to about half of the Soviet harvest. The Gulf of Alaska and grounds off Washington, Oregon, and California, therefore, have been of greater relative importance to the USSR than to Japan. This was particularly true in the early and mid-1960's when the USSR carried out a very large fishery in the Gulf of Alaska for Pacific ocean perch, *Sebastes alutus*. The great decline in abundance of Pacific ocean perch in the Gulf of Alaska, which resulted from excessive catches, led the Soviets to direct much of their fishing effort to other species and to other areas. Fishing grounds around the Aleutian Islands have contributed only a minor part of the Soviet and Japanese total harvest but have been relatively more important to the Soviets than to the Japanese.

Catches by the USSR during 1959-75 are shown in Table 3. They have been derived from various sources. As a consequence of the lack of any official statistics on Soviet fisheries for the years prior to 1964 and the gross nature of those provided for 1964-66, it was necessary to estimate catches for 1959-66. For years after 1966 the catches are as provided by the USSR to the United States under terms of bilateral agreements, except in some instances where it was possible to provide more accurate figures from direct observations by NMFS personnel or from other sources.

Bering Sea In 1959, the USSR initiated winter fisheries for both flounder and herring in the eastern Bering Sea. Both fisheries were at least in partial response to declining catches in the Soviet Far East. The herring fishery is carried out on the outer continental shelf northwest of the Pribilof Islands to beyond St. Matthew Island in some years. Largest production of herring by the Soviets was attained in 1962-64, when annual catches of from 150,000 to at least 175,000 metric tons were taken by 100-150 side trawlers. Production of herring during 1965-67 was much less and in 1968-72 averaged about 60,000 metric tons annually, with large fluctuations occurring from year to year. The Soviet catch of herring was limited to 30,000 metric tons in 1975 and 1976 under terms of a bilateral agreement with the United States.

A traditional Soviet fishery for flounder has occurred on the Bristol Bay flats of the southeastern Bering Sea. The combined catches of yellowfin sole, *Limanda aspera*, by Japan and the USSR is thought to have reached a peak of about 600,000 metric tons in 1961. Thereafter, the combined catch of yellowfin sole by the USSR and Japan dropped to around 100,000 metric tons, recovered to about 200,000 metric tons in 1969-70, then fell to only about 30,000 metric tons in 1972-73. In 1973 the Soviets practically abandoned their winter fishery for yellowfin sole in the eastern Bering Sea and diverted much of their flounder fleet to grounds near Kodiak Island in the Gulf of Alaska. The catch of yellowfin sole reported as having been taken by the USSR from the eastern Bering Sea during the 1972-73 winter fishery was only 4,500 metric tons. In 1974 and 1975 the total catches of all species of flounders combined were 39,000 and 50,000 metric tons, respectively. Most were arrowtooth flounder (turbot), *Atheresthes stomias*, and Greenland turbot, *Reinhardtius hippoglossoides*, neither of which were catch targets in earlier years when yellowfin sole was abundant. Pacific halibut, *Hippoglossus stenolepis*, is reported not to be a target of Soviet fisheries; incidental

catches of 123 and 190 metric tons of Pacific halibut were reported as having been caught in 1974 and 1975, respectively.

Declining production from its traditional herring and flounder fisheries led the USSR to seek other species in the eastern Bering Sea as well as to send parts of its fleet to fishing grounds outside the Bering Sea. Within the Bering Sea, the most significant recent event has been the entry of the USSR into the fishery for Alaska pollock which, since its inception, has been dominated by Japan. The first catch of pollock reported by the USSR from the eastern Bering Sea was in 1969 when 27,000 metric tons were taken. The Soviet fishery for pollock thereafter assumed increasing importance, exceeding 300,000 metric tons in 1974. By agreement with the United States, the Soviet catch of pollock will not exceed 210,000 metric tons in 1975 and 1976.

Other bottomfish which have been sought by the Soviets include Pacific ocean perch, sablefish (blackcod), *Anoplopoma fimbria*, Pacific cod, *Gadus macrocephalus*, and grenadiers (rattails), *Coryphaenoides* sp. The fishery for grenadiers is a recent develment in deeper waters than those in which the other species of bottomfish are found.

Aleutian Islands Area Since its inception in the early 1960's, the main target of the Soviet fishery in the Aleutian Islands area has been Pacific ocean perch. The Soviet catch of rockfish (mainly Pacific ocean perch) was over 60,000 metric tons in 1965, a level which was never attained after that. The catch of rockfish fell to 3,017 tons in 1973 and 824 tons in 1974; but it was reported to have increased in 1975 to 11,877 tons. The catch in 1975 was just under the 12,000-ton limit agreed to with the United States.

As the abundance of rockfish declined, there was some diversion to other species, such as Alaska pollock, Atka mackerel, Hexagrammidae, and grenadiers. However, switching to other target species was not sufficient to maintain the total catch at former levels. In 1973 the combined catch of all species from around the Aleutian Islands fell to an all-time low of only 17,012 metric tons. There was some

Table 3.—Catches in metric tons by the USSR of bottomfish and herring from the eastern Bering Sea and Aleutian Islands areas combined and from the Northeast Pacific area, 1959-75.

Year and type of fish	Eastern Bering Sea and Aleutian Islands	Northeast Pacific[1]	Total
1959			
Herring	10,000	—	10,000
Flatfish	75,000	—	75,000
Total	85,000		85,000
1960			
Herring	10,000	—	10,000
Flatfish	75,000	—	75,000
Rockfish	20,000	—	20,000
Total	105,000	—	105,000
1961			
Herring	80,000	—	80,000
Flatfish	75,000	—	75,000
Rockfish	25,000	—	25,000
Total	180,000		180,000
1962			
Herring	150,000	—	150,000
Flatfish	75,000	—	75,000
Rockfish	20,000	50,000	70,000
Total	245,000	50,000	295,000
1963			
Herring	150,000	—	150,000
Flatfish	75,000	—	75,000
Rockfish	27,000	108,000	135,000
Total	252,000	108,000	360,000
1964			
Herring	175,000	—	175,000
Flatfish	50,000	—	50,000
Rockfish	72,500	230,000	302,500
Total	297,500	230,000	527,500
1965			
Herring	10,000	—	10,000
Flatfish	90,000	—	90,000
Rockfish	80,000	340,000	420,000
Total	180,000	340,000	520,000
1966			
Herring	5,000	—	5,000
Flatfish	100,000	—	100,000
Rockfish	30,000	157,000	187,000
Pacific hake	—	128,000	128,000
Total	135,000	285,000	420,000
1967			
Herring	—	—	—
Flatfish	123,000	—	123,000
Rockfish	47,000	111,000	158,000
Pacific hake	—	206,000	206,000
Sablefish	trace	—	trace
Other species	8,000	18,000	26,000
Total	178,000	335,000	513,000
1968			
Herring	22,000	—	22,000
Flatfish	72,000	—	72,000
Rockfish	30,000	69,000	99,000
Pacific hake	—	104,000	104,000
Sablefish	4,000	—	4,000
Other species	28,000	34,000	62,000
Total	156,000	207,000	363,000
1969			
Herring	94,000	—	94,000
Flatfish	121,000	—	121,000
Rockfish	23,000	23,000	46,000
Pacific hake	—	162,000	162,000
Sablefish	2,000	—	2,000
Alaska pollock	34,000	—	34,000
Other species	7,000	23,000	30,000
Total	281,000	208,000	489,000
1970			
Herring	117,000	—	117,000
Flatfish	115,000	—	115,000
Rockfish	53,000	3,000	56,000
Pacific hake	—	226,000	226,000
Sablefish	3,000	1,000	4,000
Alaska pollock	45,000	—	45,000
Other species	16,000	17,000	33,000
Total	349,000	247,000	596,000

Table 3.—Continued.

Year and type of fish	Eastern Bering Sea and Aleutian Islands	Northeast Pacific[1]	Total
1971			
Herring	23,000	—	23,000
Flatfish	143,000	2,000	145,000
Rockfish	7,000	33,000	40,000
Pacific hake	—	152,000	152,000
Sablefish	3,000	1,000	4,000
Alaska pollock	236,000	trace	236,000
Other species	8,000	1,000	9,000
Total	420,000	189,000	609,000
1972			
Herring	54,000	—	54,000
Flatfish	61,000	4,000	65,000
Rockfish	25,000	27,000	52,000
Pacific hake	—	117,000	117,000
Sablefish	2,000	1,000	3,000
Alaska pollock	215,000	20,000	235,000
Other species	109,000	27,000	136,000
Total	466,000	196,000	662,000
1973			
Herring	34,000	—	34,000
Flatfish	21,000	16,000	37,000
Rockfish	3,000	14,000	17,000
Pacific hake	—	153,000	153,000
Sablefish	1,000	trace	1,000
Alaska pollock	290,000	44,000	334,000
Other species	32,000	24,000	56,000
Total	381,000	251,000	632,000
1974			
Herring	20,000	—	20,000
Flatfish	39,000	2,000	41,000
Rockfish	33,000	17,000	50,000
Pacific hake	—	159,000	159,000
Sablefish	trace	trace	trace
Alaska pollock	331,000	31,000	362,000
Other species	32,000	33,000	65,000
Total	455,000	242,000	697,000
1975			
Herring	19,000	—	19,000
Flatfish	50,000	3,000	53,000
Rockfish	39,000	13,000	52,000
Pacific hake	—	154,000	154,000
Sablefish	—	—	—
Alaska pollock	220,000	38,000	258,000
Other species	49,000	31,000	80,000
Total	377,000	239,000	616,000

[1]During the period 1967-75 approximately 10 percent of the total landings from the northeast Pacific area were from off Canada; the remaining 90 percent was from off the United States. Sources: Chitwood (1969) and Forrester, Beardsley, and Takahashi (in press) for 1959-66 data. Later data is from statistics provided by the USSR under terms of bilateral agreements with the United States, with some changes based on observations by NMFS personnel.

recovery of the catch in 1974 and 1975, but only because of an increasing diversion to pollock as a target species.

Northeast Pacific (Gulf of Alaska to California) Pacific ocean perch was the target of the Soviet fishery in the Gulf of Alaska until the abundance was reduced to where it was necessary to seek other species. Both the USSR and Japan contributed to the great reduction in abundance of Pacific ocean perch, although the larger Soviet catches in the early years of the fishery set the stage for the subsequent declines. Indicative of the depletion of the Pacific ocean perch resource are the following average, annual catches of rockfish by the Soviets from the northeast Pacific (mostly Gulf of Alaska): 242,000 metric tons in 1964-66; 68,000 tons in 1967-69; 21,000 tons in 1970-72; and 15,000 tons in 1973-75. The catch of rockfish in the northeast Pacific was limited to 12,500 tons in 1975 and 1976 by agreement with the United States.

As the catches of Pacific ocean perch declined, the Soviets began to seek other species in the Gulf of Alaska such as Pacific cod, sablefish, Atka mackerel, flounders, and grenadiers. Starting about 1972, Alaska pollock became a target of the Soviet fishery in the Gulf of Alaska and catches of that species exceeded 30,000 metric tons in 1974 and 1975. By agreement with the United States, the Soviet catch of pollock will not exceed 40,000 metric tons in 1975 and 1976.

The launching of a new Soviet fishery for Pacific hake off Washington and Oregon in 1966 largely was to compensate for the reduced abundance of Pacific ocean perch in the Gulf of Alaska. Initially, Pacific ocean perch was a secondary target in the Soviet fishery for hake. This led to the depletion of stocks of Pacific ocean perch on some grounds traditionally fished by U.S. trawlers and the demise of a local fishery of considerable importance to Oregon trawlers. Since 1971, the Soviet catch of Pacific hake has been limited by agreement with the United States to 150,000 metric tons per year, the amount believed by U.S. scientists to be the maximum sustainable yield. The recent commencement of fishing for Pacific hake by other nations, particularly Poland, which reported its catch to be 57,000 tons in 1975, has resulted in the all-nation harvest exceeding by a substantial amount what the hake resource is believed to be capable of sustaining.

IMPACT ON U.S. FISHERIES

The kinds of impacts have been much the same from the distant-water fleets of the several nations participating in fisheries off the Pacific coast of the United States. The most obvious impacts have been the preemption of fishing grounds and the destruction of fishing gear employed by U.S. fishermen. A series of bilateral fisheries agreements has been the major factor in minimizing the number and severity of conflicts over fisheries between the United States, the USSR, and certain other distant-water fishing nations. Under terms of these agreements the other nations have refrained from fishing in some areas of special interest to the United States in exchange for concessions to fish and transfer cargoes at several places within the United States' 12-mile fisheries zone.

In recent years, the agreements with the USSR, Japan, and Poland have included quotas on the catches of some species and provisions not to target on other species of particular concern to the United States. The agreement with

South Korea does not contain catch quota provisions and prohibits only the taking of Pacific halibut among the several species of bottomfish of concern to U.S. fishermen. The United States has not signed any official agreements with the Democratic Republic of Germany (East Germany), Bulgaria, or the Federal Republic of Germany (West Germany), none of whom have yet mounted large-scale fishing operations off the Pacific or Bering Sea coasts of the United States. A special feature of the agreement with the USSR has been the establishment of a board to facilitate the settlement of monetary claims arising from the destruction of fishing gear or the interference with fishing operations.

Less obvious than the above-mentioned impacts have been those arising from overfishing. For lack of adequate statistics on catches and fishing effort, it has been particularly difficult to assess the effects of Soviet operations on stocks of fish. This situation has been aggravated by the pulse nature of the Soviet fisheries, which has tended to generate massive fishing effort on localized stocks and thereby rapidly reduce their abundance. United States investigators often have not been aware that this process was occurring until after the Soviet vessels had abandoned their operations to move on to other stocks, species, or fishing grounds. This was the typical situation for Soviet, as well as Japanese operations, until recent years when safeguards in the nature of quotas on the catches of some species and provisions not to target on other species were incorporated into the bilateral agreements.

Another kind of impact has been the reduction of stocks by foreign fleets to levels at which U.S. fishermen cannot afford to fish. Such levels often have been reached before biological depletion occurred. An example is in the eastern Bering Sea, where, among the many species of bottomfish present, only Pacific halibut is sought by U.S. fishermen. There are many reasons for this anomalous situation, including distance from U.S. markets and processing plants, but a contributing factor has been that foreign fishing, particularly by Japan and the USSR, has reduced stock densities of many desirable species to the level where they no longer are capable of yielding catch rates at which U.S. fishermen can afford to fish. The early foreign fisheries operated at high catch rates as a result of fishing on previously unutilized stocks. The effect of these high catch rates was to subsidize some of the costs required to develop the harvesting and processing technology for utilizing the resources. The U.S. fishing industry will not have the same advantage unless foreign fishing is reduced or stopped for a period of several years to allow the stocks to rebuild to higher levels of abundance.

Since the Soviet fleets are operated by the State and are not governed by the same economic considerations as U.S. vessels, it is clear they could preempt the fishing grounds if it was judged to be worthwhile to do so for strategic or political reasons. While this is possible in theory, there are no documented instances where it has occurred in relation to U.S. fishermen or to those fishermen of other nations operating off the Pacific or Bering Sea coasts of the United States.

To a greater degree than Japan, the Soviets have mounted large trawl fisheries for bottomfish in the Gulf of Alaska and off Washington, Oregon, and California where there is greater opportunity for impacting on established U.S. fisheries. Although confrontations have occurred between United States and Soviet fishermen, particularly in the years immediately after the arrival of the Soviet fleets, they have been fewer than perhaps most people expected. This can be partially attributed to the different character of the U.S. and Soviet fisheries in that they tend to seek different species off Washington, Oregon, and California and, as yet, there is no large U.S. trawl fishery for bottomfish off Alaska.

On the other hand, incidental as well as some intentional catches of Pacific ocean perch by the large Soviet hake fleet has so reduced their abundance that U.S. trawlers no longer find it profitable to fish for Pacific ocean perch on certain grounds off Oregon and Washington. A similar situation occurs as regards the impact of foreign fisheries, particularly those of Japan and the USSR, on the United States and Canadian setline fishery for Pacific halibut in the Bering Sea and Gulf of Alaska. Foreign catches of halibut, particularly incidental catches of small and immature halibut, have contributed to a decline in the abundance of fish available to setline gear. This has necessitated a great reduction in the catch quotas allocated to United States and Canadian fishermen to halt the decline and hopefully to rebuild this valuable resource.

Contributing to the fewer conflicts than expected with U.S. fishermen has been the way the USSR closely directs and monitors the activities of its fishermen. Each flotilla of fishing and support vessels is directed by a Fleet Commander who considers not only the Soviet production targets but also the need to comply with US-USSR bilateral agreements, including the minimizing of conflicts with United States fishermen. Compliance of Soviet fishermen with bilateral agreements and with the Fleet Commander's decisions is monitored by a higher degree of Soviet patrol activity than by Japan and probably any other nation seeking bottomfish off the Pacific and Bering Sea coasts of the United States. A reflection of this control has been that fewer Soviet vessels in relation to the total number employed have been apprehended by the United States in violation of its fisheries zone than has been the case for Japan, South Korea, and Taiwan. For example, a large Soviet fleet has fished for Pacific hake off the Pacific Northwest and California every year since 1966; yet, no Soviet vessels have been apprehended there in violation of the contiguous fishing zone of the United States.

THE FUTURE OF SOVIET FISHERIES

Predictions for the future should consider past performance, and the performance of the Soviet fishing industry has been most impressive. Within the two decades following 1946, the USSR had rebuilt its fishing fleets, ports, harbors, and other facilities which had suffered great war-time damages. A whole new deep-sea fishing tradition, was developed and Soviet fishing fleets ploughed the world's seas. By 1967, the USSR had become the world's third largest fish-producing nation, being

surpassed only by Peru and Japan. With the collapse of its anchovetta fishery, Peru fell from first to third place in 1972 and the USSR has since maintained second place behind Japan.

The USSR has aggressively sought to improve its fishery technology and to bring latent fishery resources into production. Efforts are continually underway to improve fishing tactics and gear and to develop new concepts for harvesting fish. Examples of past Soviet successes include the upgrading of both their Atlantic and Pacific fleets by outfitting them with new mid-water trawling capabilities. This was carried out rapidly and has improved the efficiency of harvesting many species as well as made it possible to begin harvesting species which were capable of avoiding the trawls previously available. The Soviets, along with the Japanese, have pioneered the development of an entirely new fishery for Antarctic krill, a small, shrimp-like animal capable perhaps of yielding catches as large or larger than the current world fish harvest.

Several factors mitigate against the further expansion of Soviet fisheries despite the importance attached to such expansion by the USSR. These factors apply to the distant-water fisheries of other nations as well as to those of the USSR. Many traditional fishery resources have been depleted by intensive international fisheries and this has resulted in declining harvests. International competition for resources has increased as many nations built up their distant-water fleets and as other nations launched new distant-water fisheries. Besides contributing to overfishing and reduced yields, this has meant that the harvests have had to be divided among more nations, with less for each. In addition, the unilateral extension of fishery zones by many nations has closed or reduced access to many important fishing grounds, and it is likely that international consensus will soon be reached for a worldwide extension of fishing limits by coastal nations to 200 miles from shore.

To date, Soviet planners appear to be relatively unimpressed by the worldwide signs which argue for caution in further expansion of fishing fleets. Some 900 new fishing vessels and 70 refrigerator transports were added to the Soviet fleet during the recently completed Ninth Five-Year Plan (1971-75). Capital investments for vessel construction during the next Five-Year Plan (1976-80) will be less, with a change in emphasis to smaller vessels for coastal fisheries and more automation aboard processing vessels. On the other hand, it was recently announced that the USSR had placed the most valuable single order (US$250 million) in the history of the Polish shipbuilding industry to construct 11 fish factoryships of a new design for delivery from 1978 through 1980. These factoryships will be 178 meters in length and have a potential for processing daily 100 tons of whole fish into frozen products, salting at least 150 tons of fish, canning 20 tons, and producing 100 tons of fish meal. Five other factoryships of a new and larger class, *Piatidesiatiletie*, will be built in Leningrad. They are 197 meters in length, with a crew of 500 and designed to operate with a fleet of catcher vessels in the development of underutilized species. Dozens of large refrigerator transports of a new class, *Piatdesiat Let*, are planned for construction which reportedly will last through 1990. These refrigerator transports are 172 meters in length and have a storage capacity of 16,200 metric tons.

Tests are also proceeding with new classes of supertrawlers to further increase or modernize the Soviet distant-water fleet of catcher vessels. Among the supertrawlers is the *Gorizont* class of factory stern trawlers which are 113 meters in length, 5,500 gross tons, 7,000 horsepower, and can produce up to 90 metric tons of frozen fish per day and store 2,000 metric tons in freezer holds. Another class of supertrawler is the *Meridian*, which is designed to replace the smaller *Maiakovskii* class BMRT factory stern trawlers. *Meridian* class vessels are 103 meters in length, 4,000 gross tons, 6,000 horsepower, and can produce up to 60 metric tons of frozen fish daily (double the *Maiakovskii* class) and store 1,500 tons (1.7 times the *Maiakovskii* class). The *Meridian* class has been ordered into serial production at Black Sea shipyards in the USSR.

The ambitious shipbuilding program by the USSR seems inimical to trends on the world fisheries scene. It is difficult to determine, however, how much of it is to further increase distant-water fishing capabilities, to replace outmoded vessels, or merely to subsidize shipyards in the Communist-bloc nations.

The future course of the Soviet fisheries off the Pacific coast of the United States will be influenced by many of the same factors influencing the fisheries of all nations which plan to fish there. Most important will be the implementation by the United States of a 200-mile fisheries zone on 1 March 1977. It seems probable that the USSR will recognize this unilateral action by the United States, if not officially at first, at least on an interim de-facto basis.

All foreign nations which fish after 1 March 1977 within 200 miles of the United States coast will be required to conform with certain requirements. These requirements include abiding by terms of Fisheries Management Plans to be developed by Regional Councils, which presumably will establish limits on the catches by foreign nations and will require that they obtain permits for their vessels; provide the United States with timely reports on their catches and other aspects of the fishing operations; and reimburse the United States for their fair share in the costs incurred for research, management, and enforcement. The initial effect on the USSR and other nations fishing within 200 miles of the U.S. coast will be to increase their operating costs and to reduce their catches of some presently overfished species and catches of some species which the United States is capable of utilizing. The USSR, in particular, will have to revise its reporting system to provide the United States with more detailed statistics on its fishing operations than it has in the past. Such reports, along with those from other nations, will be subject to verification by U.S. observers aboard the foreign vessels and by other means.

The subsidized and State-controlled nature of its fisheries seemingly should be an advantage to the USSR under extended jurisdiction, compared to Japan and other non-Communist nations. For example, the additional costs incurred could be absorbed by simply increasing the price of fish to the

Soviet consumer or might be justified solely on the basis of keeping people employed. As remarked earlier, the Soviet fisheries have been less efficient than those of at least Japan. Contributing to this situation has been that more people are employed by the Soviets on catcher and support vessels and they use more catcher and support vessels to obtain a given catch. Thus, it should be easier for the Soviets than the Japanese to increase productivity and thereby absorb the additional costs.

The above features of Soviet fisheries have important implications to the United States under extended jurisdiction. A benefit should be the ability to comply closely with United States requirements since the actions of Soviet fishermen are closely watched and controlled by the Fleet Commanders who carry out the orders of the State. Another benefit could be the cooperative use by United States and Soviet investigators of some of the many vessels in the Soviet fleet to carry out research on species and stocks of particular concern to the United States.

The relatively low efficiency of the Soviet fisheries poses important policy questions for the United States. Should the number of Soviet vessels to be issued permits be based on past performance or some "productivity norm" which is more comparable to that of, say, Japan? If past performance is the criterion, or no criterion is used, there will be considerably more Soviet vessels employed to take their assigned catch quota than would be employed by Japan to harvest the same quota. This could mean greater enforcement costs to the U.S. Government and the potential for more conflicts with U.S. fishermen than would be the case for another nation whose operations were more efficient.

As remarked earlier, a characteristic of the USSR has been the aggressive way it has developed new fishing technology and sought previously unexploited species. We can perhaps expect this policy to be intensified under extended jurisdiction as the Soviets seek to bring into production latent resources which are of no or low current interest to the United States. Included may be pelagic and deepwater fishes within 200 miles of the U.S. coast as well as high-seas pelagic forms such as lanternfishes, squids, and others which may occur in fishable aggregations over 200 miles from shore.

Along with Japan and other distant-water fishing nations, the USSR has been increasingly seeking joint fishing ventures with coastal nations. Joint ventures are particularly being sought with nations who already have or are expected to soon extend their zone of fisheries jurisdiction. Such ventures are a means of insuring a supply of fish for the homeland, keeping people and vessels employed and, if allowed to sell part of the catches to the coastal nations, of obtaining foreign currency. Proposals from the USSR for various kinds of joint ventures can be expected as a consequence of the United States extending its zone of fisheries jurisdiction. In making such proposals, the USSR would be well served by its large fleet of factoryships and refrigerator transports which could be offered to receive and process fish caught by U.S. fishermen. Such offers might be viewed by some as being particularly attractive on grounds, such as in the eastern Bering Sea, which are remote from U.S. facilities for processing bottomfish, but where a fleet of modern U.S. crab vessels operate and could readily convert to trawling. Similar proposals can be expected to be made by other nations, such as Japan.

Ultimately, the emphasis placed by the USSR on distant-water fisheries as well as on its own coastal fisheries will depend upon their productivity in relation to that of agriculture, the other major source of animal protein. In terms of output of animal protein per given expenditure of manpower, fisheries, until now, have been considerably more productive than agriculture within the USSR. Also favoring the past promotion of fisheries is that most agricultural products are produced by collective farms, which are more difficult to manage than distant-water fisheries. Until this situation changes, and until the costly investments which have been made and are still being made by the USSR in its high-seas fishing fleets have been amortized or rationalized, we can expect a continued presence of Soviet fishing vessels off the Pacific coast of the United States.

ACKNOWLEDGMENTS

All photographs, except Figure 6 by the author, were provided by the Law Enforcement Division, Alaska Region, National Marine Fisheries Service. Much other valuable help and advice was provided by staffs of the Law Enforcement Divisions in both the Alaska and Pacific Northwest Regions, National Marine Fisheries Service.

MFR Paper 1225. From Marine Fisheries Review, *Vol. 38, No. 12, December 1976. Copies of this paper, in limited numbers, are available from D825, Technical Information Division, Environmental Science Information Center, NOAA, Washington, DC 20235. Copies of* Marine Fisheries Review *are available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402 for $1.10 each.*

MFR PAPER 1226

The Evolution of Fisheries Management Philosophy

LARRY A. NIELSEN

ABSTRACT—The attitudes governing the management of fishery resources have evolved in important ways during the past 125 years. In 1850, the concept of inexhaustibility stood firmly entrenched, buttressed by tradition, history, the rights of freedom, an untested logic, and Thomas Henry Huxley. The increased fishery exploitation wrought by population increases and technological advances so depleted the stocks of valuable fish that by 1900 the concept of inexhaustibility was forced into submission. The logic of exhaustibility arose in response, and the simultaneous search for biological information and simple management solutions produced a predominant interest in maximizing the physical yield from aquatic environments. The undercurrent of nonbiological forces grew steadily as biologically oriented management failed to produce satisfactory benefits from fisheries resources. The emergence of numerous other criteria relevant to management has fostered the realization that the goal of fisheries management is to optimize society's total benefit from the use of natural resources.

The profession of fishing is among the world's oldest; the profession of fisheries management, however, still labors in adolescence. Concern for the management of fisheries has emerged basically since 1850 and the ideas embodied in fisheries management have evolved greatly between 1850 and the present. Fisheries professionals currently praise the notion of "optimum sustainable yield" as a desirable objective for fisheries resource management. They contend that this viewpoint represents a major development in management philosophy. My intention in this paper is to provide a brief historical survey of the evolution of fisheries management philosophy since approximately 1850, tracing the factors which have led to the optimum sustainable yield philosophy. I have relied almost exclusively upon literature concerning the British Isles and the United States, since that information is most readily accessible and provides a substantially continuous record.

THE DEBATE OVER INEXHAUSTIBILITY

Before approximately 1850, the fisheries of the oceans and large inland lakes were generally considered inexhaustible (MacKenzie, 1860; Whitaker, 1892). Fisheries had been pursued near the shores of oceans and lakes for centuries, and the mysterious waters seldom failed to supply the resources which were sought. This supposed infinity of fishes was one of two facts considered important when Hugo Grotius founded the principle of "freedom of the seas" in 1608 (Christy and Scott, 1965). On the one hand, establishing boundaries on the high seas and enforcing those boundaries was a formidable task. On the other hand, if fishes and other resources could be harvested without limit, as seemed reasonable at the time, maintaining exclusive rights to oceanic resources was unnecessary.

It is relevant, however, to note that not all fisheries were considered inexhaustible. The reality of depleted fisheries in small bodies of water, such as rivers and smaller lakes, had long been recognized. Restrictive regulations existed in the British Isles since at least 1278 (Graham, 1956) and were enacted in North America not long after the landing of the Pilgrims (Idyll, 1966). Human intervention had become an obviously great force in some fisheries, such as in the rivers of the St. Lawrence basin where destructive fishing and dams which spanned the entire breadth of rivers caused declining salmon fisheries (Nettle, 1857). These obstructions permitted the capture of all fish or prohibited the migration of fish to spawning grounds. The supposed difference between oceanic and inland fisheries is further illustrated by the opinions of Thomas Henry Huxley, one of the most eminent scientists and most influential commentators on fisheries during the later nineteenth century. Huxley, while espousing the effective inexhaustibility of oceanic resources in 1860, testified that excessive fishing and poaching had depleted the salmon fisheries in Scottish rivers (Great Britain, 1860).

The first to question the inexhaustibility of coastal fisheries were British fishermen, who frequently complained of depleted fisheries before 1850 (Johnstone, 1905). The complaints were usually accompanied by accusations that competing types of fishing gear caused the alleged depletions. A new technique called "trawling" was the most popular scapegoat and various politically-oriented restrictions on trawling and other methods were

Larry A. Nielsen is a graduate assistant at the Department of Natural Resources, Cornell University, Ithaca, NY 14853.

enacted before 1850 in both the British Isles and the United States.

The dissatisfaction of British fishermen intensified, and precipitated the appointment of various Royal Commissions to more fully investigate the status of fisheries. The most influential was the commission of 1863, comprised of James Caird, G. Shaw-Lefevre, and Thomas Huxley. The commission heard testimony of 3 years and produced a 1,588-page report which verified the traditional view of inexhaustibility (Great Britain, 1866). The commission cited the following reasons as the basis for their conclusions. The oceans were enormous, almost beyond comprehension, and since the small regions then under exploitation were very productive, the reservoir of unexploited areas of supposedly equal productivity promised an effectively infinite supply of fish. The natural predators of fish were so numerous and the human harvest was so small in comparison that fishing was an insignificant cause of mortality and could never alter population sizes. Fish, moreover, were known to be enormously fecund, such that the harvest of even large numbers of fish could be offset by the egg production of only one female. Concern about maintaining a large broodstock was, therefore, unnecessary. The commission's analysis of catch statistics, extracted from railway shipping records, revealed that total supplies of fish were actually increasing, not decreasing, and they reasoned that stable prices indicated no depletion of the stocks. This commission, along with most others, emphasized total catch, and discounted as biased the testimony by fishermen that their individual catches (the catch per unit of effort, CPUE) were declining. Since fishermen could operate wherever they wished, a decreased supply of fish in one area would merely cause a change in fishing grounds. Thus profitability of fishing would prevail, and depleted local stocks would recuperate naturally, without regulatory interference (McIntosh, 1899).

The belief in inexhaustibility was also desirable from a practical viewpoint. If governments admitted that fisheries had been or could be depleted, avoiding that depletion would necessitate restrictions on fisheries, and restrictions were undesirable. Fishing was a complex industry in which the same stocks were exploited by fishermen from many nations using many techniques. Effective regulations would confront the complex problems of fairness and political reality; it was more expedient to avoid regulations altogether. Most importantly, regulations infringed upon personal liberty, and without strong evidence that regulations would help, rather than hurt, the fishermen, acts to limit their personal freedom were considered crimes against humanity. This attitude was aptly summarized in the report of an earlier commission, of which Huxley was also a member, assigned to investigate the atrocities of the herring trawl:

> "Under such circumstances, the herring fishery should not be trammelled with repressive Acts, calculated only to protect class interests, and to disturb in an unknown and possibly injurious manner the balance existing between the conservative and destructive agencies at work upon the herring. If legislation could regulate the appetities of cod, conger, and porpoise, it might be useful to pass laws regarding them; but to prevent fishermen from catching their poor one or two per cent. of herring in any way they please, when the other ninety-eight per cent., subject to destructive agencies, are poached in all sorts of unrecognized piscine methods, seems a wasteful employment of the force of law." (Great Britain, 1863.)

The British Parliament accepted the opinions of the 1863 commission and, in 1868, abolished all regulations regarding the capture and sale of marine fishes. This action set two standards which characterized future fisheries management policies. First, the idea that regulation of fisheries was both unnecessary and impractical became the cornerstone for the decades of laissez-faire management which followed. Second, the importance attached to the personal liberty of fishermen became an obstacle which has inhibited changes in the management of the fishery industry.

Despite the apparent conclusiveness of the 1863 commission, the debate over the depletion of fisheries had hardly begun. Concern in Russia precipitated a series of official expeditions which investigated the condition of fisheries throughout the country. A major expedition to the Barents Sea in 1851 confirmed that fisheries for cod and other species had deteriorated and required regulation (Borisov, 1960). The German government established the Kiel Kommission in 1870 as a scientific organization to study all aspects of the marine environment which related to fisheries. In 1871, the U.S. Congress inaugurated the U.S. Commission of Fish and Fisheries, which was designed to "prosecute investigations on the subject (of the diminution of valuable fishes) with the view to ascertaining whether any and what diminution in the number of the food-fishes of the coast and the lakes of the United States had taken place; . . ." (Goode, 1886). Popular accounts of British fisheries continued to expound the reduced catches per unit of effort (Fig. 1; Bertram, 1873). Responding to continued clashes among fishermen in the North Sea, the British Parliament called another commission in 1878. The commissioners used the same logic and data which had convinced Huxley, however, and echoed earlier conclusions of inexhaustibility.

The debate congealed at an International Fisheries Exhibition held in London in 1883. An impressive audience attended, and the 15 volumes of official literature attest to the contemporary influence of the proceedings (London. International Fisheries Exhibition, 1884). In his inaugural address, Thomas Huxley espoused the traditional view of laissez-faire and emphasized the injustice of regulations which were inflicted without proven need or benefit. Other British contributors concurred with Huxley's position, as did G. B. Goode, head of the U.S. Fish Commission. Moreover, the United States proclaimed its intention to avoid any need for future restrictions by using artificial propagation to assure infinite fish stocks.

The harbingers of exhaustibility were also well represented and vigorously rebutted the established viewpoint with the following arguments. If fisheries were indeed inexhaustible, what was the need for artificial propagation? The enormous fecundity of fishes provided no vast excess of spawn, but was nature's way of

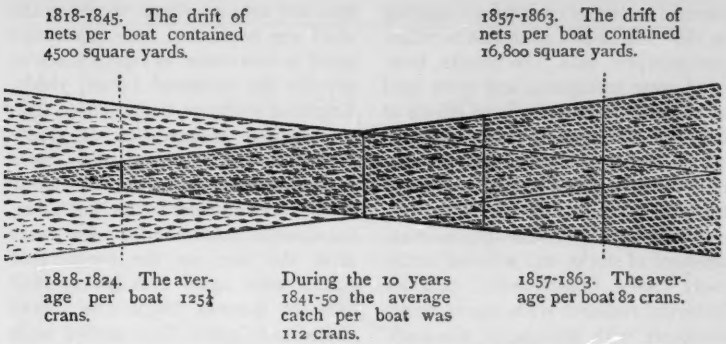

1818-1845. The drift of nets per boat contained 4500 square yards.
1857-1863. The drift of nets per boat contained 16,800 square yards.
1818-1824. The average per boat 125¼ crans.
During the 10 years 1841-50 the average catch per boat was 112 crans.
1857-1863. The average per boat 82 crans.

Figure 1.—The declining abundance of herring in Scottish coastal waters is illustrated by the decreasing catch per effort of Scottish gillnet fishermen, 1818-63. Reprinted from Bertram (1873).

assuring the production of just two more adults in the face of natural mortality. The fishing gears which destroyed these supposedly extra immature fish, therefore, were not innocuous, and the capture of fish before they had spawned and contributed to future populations was illogical. The fact of localized depletion was real, as evidenced by reduced catch per unit of fishing effort. The refusal of governments to react to such depletion caused a change in fishing grounds that reduced the welfare of fishermen by increasing the costs and dangers of fishing. The debate was lively, and despite the aura of Huxley's presence, the exhibition represented a victory for the proponents of exhaustibility (Graham, 1943).

Changes in the technology of the fishing industry and consequent changes in attitudes toward fisheries resources began to accelerate during this period. The supposedly infinite Great Lakes fisheries became imperiled by the employment of pound nets after 1850 and by freezing processes after 1868, which changed local fisheries into a rapidly expanding industry (Whitaker, 1892). Another British commission met in 1883, and this time acknowledged in a very limited way the decline of some fisheries (interestingly, Huxley was also a member of this commission, but ill health prevented his participation). Between 1885 and 1900, the coastal fisheries of the North Atlantic were revolutionized by the otter trawl and the widespread use of steam for power (Johnstone, 1905). North Sea fisheries had so obviously deteriorated that an organization of commercial fishermen voluntarily closed certain grounds between 1890 and 1892. Despite dramatic increases in the effectiveness of the British trawling fleet, the total annual catches increased little, if at all (Fig. 2; Johnstone, 1905).

A British Select Committee fully acknowledged the reality of depletion in 1893. The committee blamed the declining catches on the destruction of immature fish and urged action to prohibit the sale of fish below specific sizes. Their recommendations, however, fell of deaf ears in Parliament and produced no action. Nevertheless, the position of the 1893 Select Committee illustrates the general attitude at the turn of the century: not only were oceanic fisheries exhaustible, but they were rapidly being exhausted (Garstang, 1900).

BIOLOGICAL MANAGEMENT FOR MAXIMUM SUSTAINABLE YIELD

After the turn of the century, the exhortations of both popular authors and fisheries personnel generated extensive agreement on the general

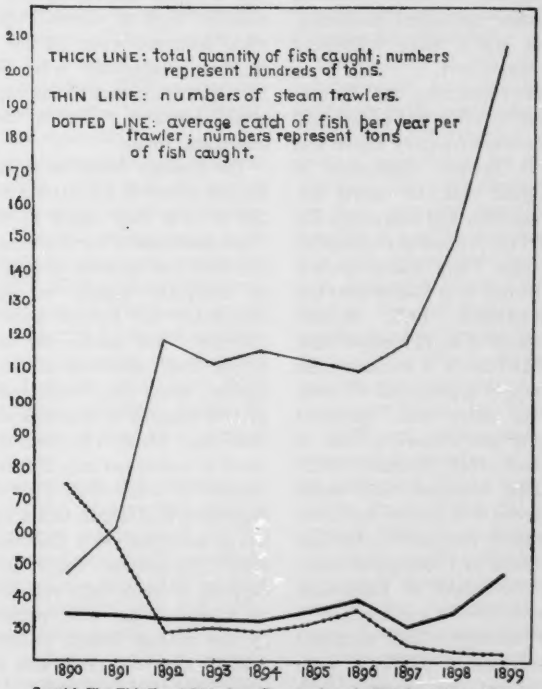


Figure 2.—The declining abundance of flat fishes from 1890-99, is illustrated by the stability of total catch while the fishing fleet greatly expanded. Average catch per effort decreased steadily, except in 1895 and 1896, when otter trawls first replaced beam trawls in general use. Reprinted from Johnstone (1905).

causes of depletion. Overfishing and improper fishing accounted for the depletion of oceanic fisheries. A wider variety of causes had injured anadromous and freshwater fisheries, including overfishing, improper fishing, and habitat disruptions such as dams and pollution (Blackford, 1916). These generalizations lost their force, however, when the questions focused on specific problems and solutions. Demands for fisheries products and the exploitation and depletion of fisheries had developed within a complex framework which depended extensively on local characteristics. Fisheries had been managed with the local "stock" as the unit of consideration, and regulatory jurisdiction had been predominantly local. Similarly, attitudes toward fisheries resources have not evolved along a simple chronological path, and the portrayal of one in this paper would be misleading. This section, therefore, emphasizes the biological aspect of management, and the following section examines other coexistent nonbiological criteria which have influenced fisheries management.

The debate concerning the destructive effects of trawling and using small meshed nets was especially active and persistent in Britain. Opponents of trawling argued that the trawls disrupted the sea floor and destroyed fish eggs and larvae; proponents countered that the damage, if any, was temporary and that most fish eggs floated near the surface (Johnstone, 1905; Howell, 1921). Opponents of small meshes cited the capture and death of unmarketable fish, while others argued that all nets, regardless of mesh size, collapsed during towing and allowed no fish to escape (Russell, 1942; Graham, 1943). One conclusion, however, with which everyone agreed was that no one knew very much about the subject (Howell, 1921). Fish lived in a foreign environment, and the extent of knowledge regarding most species was confined to fishing methodology. The statistics used by analysts of fisheries were generally indirect (for example, railway shipping records) and characteristically lacked the definition required to draw detailed conclusions. In a pioneering attempt to resolve the question of trawling effects, the Scottish Fishery Board experimentally closed a section of coastline to trawling in 1886, and hired a naturalist to collect and interpret data. The results, however, were ambiguous, and were used as evidence proving both no effects of trawling (McIntosh, 1899) and ill effects (Garstang, 1900). The absence of knowledge which had been intellectually deplorable in the preceding century became a critical gap as management of stocks was solicited in the early 1900's. Consequently, calls for biological research were issued simultaneously with appeals for the management of fisheries.

A logical rationale for regulating fisheries, however, had evolved prior to any dramatic outcomes of fisheries research. The fact that depletion had occurred as fishing pressure increased was empirical evidence that instead of infinite effort generating infinite yields, there was some intermediate effort which yielded the greatest amount of fish. A typical argument was a logical analogy to the "capital-interest" system, wherein the highest yield occurred when all the interest (annual production) was used, but further exploitation of the capital (the stock) lowered yields in the future (Bertram, 1873).

The analogy failed to explain what factors affected the capital supply of fish or how they might be managed. The experience of the previous century provided two general answers. First, an adequate supply of eggs was necessary for future generations; therefore, fish should not be caught before they spawned at least once. Second, small fish would continue to grow if allowed to live to a somewhat older age; hence, the yield in weight could be sustained only by ceasing the capture of small fish. This rationale suggested that length limits for landed fish or minimum mesh size restrictions were appropriate ways to assure supplies of both eggs and large fish. Such regulations were recommended by the British Select Committee of 1893 (Johnstone, 1905) and have become standard methods of fishery regulation.

A more direct approach to management was to limit the total annual catch of fish by means of a quota system. This could ensure that the harvest would not exceed the annual production, and in cases where rebuilding the stock was necessary, some production could be reinvested as capital stock to provide for increased future yields. Empirical evidence that reduced fishing allowed recuperation of stocks emerged when fishing effort was necessarily reduced during World War I. The catch of plaice in the North Sea, for example, increased for a few years after the war, as the recuperated stocks were again heavily exploited (Fig. 3; Russell, 1942). The United States and Canada have applied catch quotas throughout the regulation of the Pacific halibut fishery. In 1932 a joint commission empirically set an annual quota, which was then gradually increased in subsequent years (Graham, 1956; Bell, 1970). With the quotas in effect, the stock of halibut, total annual catches, and catches per unit of effort all increased. Contemporaries judged the management program a great success, and envisioned through it the promise which biological management held for the successful exploitation of the sea (Russell, 1942).

More theoretical explanations of depletion were developing in concert with these more-or-less logical and empirical ideas. In Russia in 1918, Baranov published a mathematical model which related the size of fish stocks to the intensity of fishing. Baranov's theory, however, was disdained in Russia (Borisov, 1960) and was largely unavailable to the western world. During the 1930's, E. S. Russell developed the now classical "Russell's equation," which linked stock abundance to additions via growth and recruitment and to losses via natural and fishing mortality (Russell, 1942). The outcome, therefore, of both empirical and theoretical reasoning has evolved into the generalization that for a stock of fish there exists a maximum sustainable yield (MSY) and an associated level of fishing which will achieve that yield. It is important to note that this generalization concerns total catch, which is a biological phenomenon related to the stock, rather than CPUE, which is a phenomenon associated with the fishermen. This predominantly biological inclination of fisheries research and administration has persisted throughout the development of fisheries management.

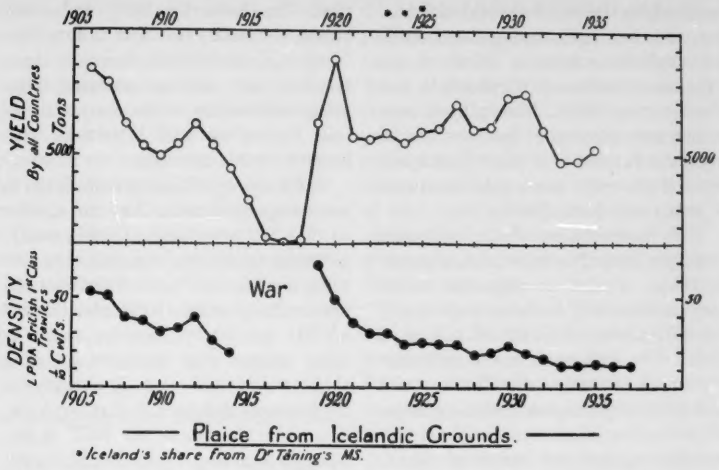


Figure 3.—The recuperation of plaice stocks during the cessation of exploitation is illustrated by increased total catch and catch per effort in the years immediately following World War I. Reprinted from Russell (1942) by permission of Cambridge University Press.

The realization that maximum sustainable yields exist, however, is different from the acceptance of MSY as an appropriate goal for fisheries management. Why did MSY become the principal goal of fisheries management following the turn of the century? First, biologists were charter members of the fisheries management profession. The depletion of fish stocks as a precursor to management caused simultaneous concern for both the fishing industry and the biology of fishes. Biologists, rather than representatives of industry or politicians, generally comprised agencies created to investigate fisheries, draft recommendations, and even enact regulations (Tomasevich, 1943). The first North American Fisheries Policy, ratified by the American Fisheries Society in 1938, decreed that fisheries management should be devoid of political pressure and that biological facts should be the primary basis for management. Moreover, fisheries had prior rights wherever fish occurred, and any loss of fisheries potential should be fully mitigated (Wickliff, 1938).

Second, MSY was an objective criterion. The fisheries regulations which existed in the nineteenth century had been enacted in response to subjective political pressures, and, as Huxley emphasized, were in no way beneficial to fisheries. Maximum sustainable yield contrasted as a logical, scientific foundation for a type of management which focused on the fish, not on the fishermen. Management for MSY could assure the continuation of the stocks and the increase of total catch, as illustrated for Pacific halibut. As a theoretical objective, MSY avoided the myriad problems now labelled "social, political, and economic."

Third, maximizing the food resource was a worthy public goal. Managing fish stocks to attain maximum production was identical to managing agricultural lands for maximum production (Bower, 1910). Either underutilizing or overutilizing a stock of fish wasted food which was essential for human welfare. This rationale pervades the fisheries literature between 1910 and 1920, when providing wartime foodstuffs was a patriotic, as well as a humanitarian, concern.

For these reasons, the objective of attaining MSY's became the avowed goal of fisheries management. In the USSR, the revolution of 1917 established maximizing the production of food as a primary political goal and eliminated many of the social, political, and economic problems which complicate fisheries management in capitalistic societies. The goal of MSY has consequently enjoyed considerable success within the large inland lakes and reservoirs which are important sources of Soviet commercial fish production (Borisov, 1960). Maximum sustainable yield has been the implicit or explicit goal throughout the history of Pacific halibut management (Bell, 1970). The 1958 Law of the Sea Conference in Geneva adopted MSY (although the wording states "optimum," the intent is maximum) as the appropriate objective of international fishery management (Christy and Scott, 1965).

NONBIOLOGICAL CRITERIA FOR MANAGEMENT

Despite its prevalence in fisheries literature, biological management for MSY has witnessed only limited implementation. Maximum sustainable yield is singularly attractive to biologists because it is biological and scientific, devoid of the complications associated with human factors. The nonbiological factors involved in establishing management policies are no less important than the biological factors, and the aloofness of MSY has been a liability, rather than an asset, for its implementation. Nonbiological criteria have gradually become more relevant during this century as the exploitation of fisheries has expanded.

The inability of MSY to represent acknowledged attitudes surfaces immediately in the conflict between sport and commercial fisheries. The importance of sport fishing for psychological well-being has been likened to that of the finer arts, and expositions of the benefits of angling appeared side-by-side with exhortations for maximizing food production (Perce, 1910). Nevertheless, the importance attached to maximizing food production, especially during World War I, allowed commercial fishing to devastate the stocks of some sport fishes. The Black Bass Act of 1926 and subsequent legislation represented victories for sport fishing by protecting highly regarded game species from commercial exploitation (Stroud, 1966). Sport fishing is regarded by some people in the United States as a more desirable allocation of resources than commercial fishing because the recreational benefit extends to more people (Hazzard and Voigt, 1957).

The relevance of nonbiological, especially economic, criteria for commercial fisheries management was realized very early in the evolution of fisheries problems. It was commercial fishermen themselves, concerned about reduced

profitability, who aroused the official machinery of commissions and committees in the nineteenth century. A predominant figure in the modern exposition of economic considerations was Michael Graham (1943), who penned the "Great Law of Fishing" in his book "The Fish Gate": unregulated fisheries become unprofitable. This book represents a unique analysis by a biologist of the entire spectrum of the fishing industry. Graham concluded that all aspects of fisheries required regulation, especially the amount of fishing effort applied to achieve a given catch.

The importance of nonbiological factors in the management of the Pacific halibut fleet attracted attention at about this time. The quotas applied to that fishery had served the intended functions, but also caused the normal fishing season of 9 months to shrink regularly as competition increased. The constriction of the season was initially cited as an indication of enlarged stocks (Russell, 1942), but its continued reduction more importantly signaled the build-up of excessive capital in the industry. Other effects included instability in the associated processing industry and local stock depletions where capture was easiest early in the season (Crutchfield and Zellner, 1962). In 1952, the halibut convention was modified to spread the catch more evenly in both time and space (Graham, 1956).

Beginning in the early 1950's, a large body of economic literature has accumulated which portrays fisheries as classical examples of common property resources. The essential features of such a resource are that no one pays for its use and no one assesses the yields derived from additional units of effort. Consequently, as long as any profit is being made, additional effort will be expended, either by more fishing per fisherman or by more fishermen, until profits as a whole decline to zero. Economists argue that the intended goal of the fishing industry is not to maximize the gross product, which is analogous to the physical yield of fish, but to maximize the net economic revenue, that is, the profit. Even from a theoretical standpoint, the overall goal of society should be to allocate all its resources to maximize total benefit; maximizing the physical yield of fisheries, and then squandering that benefit by applying excessive effort to its capture is foolhardy (Crutchfield and Pontecorvo, 1969). The proper economic management of fisheries should regulate harvest and effort to achieve maximum net economic revenue (Christy and Scott, 1965).

The incorporation of an economic criterion into fisheries management, however, carried an important corollary: economic principles only apply where property rights exist (Christy, 1969). The various forms of property rights all encounter significant social and political problems, including proper allocation of the resource among nations, regions, and individual fishermen, and the displacement and adequate compensation of those denied access. Economic management of fisheries, therefore, opens the Pandora's box of problems which the biological criterion ignored.

A development analogous to the formalization of the economic criterion for commercial fisheries has also occurred for recreational fisheries. The awareness that "sport" should be the emphasis in sport fishing (Davis, 1938) has become well established in fisheries management. The accelerating urbanization of the U.S. population and the corresponding shrinkage of available fishing resources have recently spotlighted concern for the quality of that sport. In 1969, James T. McFadden, relying on concepts from commercial fisheries, added the criterion of "aesthetics" to the traditional curve of physical yield versus effort (McFadden, 1969). Aesthetics in this case included the entire range of nonharvest values associated with sport fishing. McFadden deduced that available techniques could accommodate any level of sport harvest or effort; the challenge to management was to ascertain the values of the public and incorporate those values into management objectives. The recognition that the subjective criterion of "quality" is relevant to sport fishing invites political, social, and economic considerations into the formerly biological field of sport fisheries management.

Even within the realm of biology, MSY suffers recent attacks by what might be termed an ecological criterion. The basis for MSY and most economic analyses has been the "stock"; a stock of fish, however, does not live in a vacuum, isolated from other components of the ecosystem. A few examples will illustrate the breadth of this criterion.

The majority of fishing techniques in use today catch more than one species of fish at one time. Consequently, although reasonable regulation may be prescribed for one method aimed at the species in question, incidental catches of that species by fisheries aimed at other species may substantially alter the intended total catch. The reality for multispecies fisheries is that exploitation of all the stocks for MSY is impossible (Gulland, 1968). The biological associations among species are critical determinants of population sizes. Thus, if both predator and prey species are commercially valuable, exploitation of the prey species at MSY may reduce the yield from the predator species. Human selectivity is also important because demands for fishery products usually specify certain sizes, life stages, or species of fish as the most desirable. Such characteristics do not necessarily correspond to those accompanying MSY.

The influence of politics in fisheries management has been an important ingredient since management was first envisioned, and has usually run counter to the ideas of both biologists and economists. When a British commission finally saw the need for management in 1893, Parliament ignored its recommendations. The biologically based recommendations made between 1902 and 1925 by the Plaice Committee of the International Council for the Exploration of the Sea succumbed to contemporary political problems (Russell, 1942). Whereas the 1958 Law of the Sea Conference accepted MSY in a formal resolution; that resolution has never been ratified by all the participating nations. The necessity for fisheries personnel to address politicians in more persuasive and less scientific terms has been voiced throughout this century (Evans, 1907; Mollan, 1920; Cushing, 1972).

THE PHILOSOPHY OF OPTIMUM SUSTAINABLE YIELD

The existence of these additional criteria for management of fisheries

resources does not mean that each new criterion was smoothly absorbed into the existing realm of fisheries management. Only recently have the various disciplines associated with fisheries begun to accept the relevance of all criteria as the unified basis for achieving optimum sustainable yield (OSY). In 1974, the International Association of Game, Fish and Conservation Commissioners and the Sport Fishing Institute resolved that OSY should replace MSY. The American Fisheries Society did likewise in 1975. What OSY philosophy entails and where the formal recognition of OSY leads fisheries management are the subjects of this section.

The significance of McFadden's (1969) thesis, apart from the formalized treatment of aesthetics, is his admission that the addition of quality factors to effort-yield graphs reveals nothing about what the objectives of management should be. Graphs merely describe the relationships between various related parameters. Similarly, Royce (1975) expressed the opinion that concentration on MSY represented a perversion of the function of a model. The yield-effort model describes the resultant yields over a broad range of efforts; the fact that one of those yields is a maximum is a property of the model, and in no way implies that achieving that maximum is desirable.

This realization represents a primary impact of the OSY philosophy. It severs fisheries management from the grasp of any established discipline, and greatly expands the framework for decision-making. The American Fisheries Society, in a revised American Fish Policy in 1954, deleted the priority right of fishing, and admitted that fishing was only coequal with other aspects of the multiple use of aquatic resources (Hazzard, 1954). The recent American Fisheries Society symposium which examined OSY (Roedel, 1975) nowhere prescribed what the "optimum" is, but only expressed the relevance of political, social, and economic criteria for decision making.

By this admission, fisheries management subjugates itself to the overall benefit of society as society, not fisheries science, perceives it. In some cases, the importance of fisheries might be judged inconsequential in relation to needs such as mineral exploitation, waste disposal, or the maintenance of favorable diplomatic relations. The provision of broad recreational opportunities might justify the abandonment of sport fishing in some waters in favor of uses such as swimming or waterskiing. Such decisions based on OSY philosophy are rational dispositions of fisheries resources.

The management of Murray Reservoir in San Diego, Calif. (Ball, 1967), exemplifies this aspect of OSY. Murray Reservoir is one of a series of reservoirs built in the early 1900's to store water for San Diego consumers. Until 1950, the reservoir was fed by surface run-off with sufficient nutrient content to support a productive warmwater fish community and a vigorous fishery. After 1950, nutrient-poor water diverted from the Colorado River became the major input to Murray Reservoir, and aquatic plants were removed to reduce water loss from transpiration. In consequence, the fish production declined, and the fishery dwindled to a few thousand anglers per year. A strictly biological approach to this situation is the addition of fertilizer to enhance fish production. Fertilization, however, conflicts with the goal of providing high-quality municipal water. An alternate solution was begun in 1959, with the establishment of a "put-and-take" rainbow trout fishery during the 6-month season when water temperatures permitted trout survival. The response was an annual use (1962-65) by more than 50,000 anglers who removed 92-96 percent of the stocked trout. Ball (1967) concedes that the approach is not "fishery management per se." Under the precepts of OSY, however, such a program is fisheries management in the broad context of societal goals.

The goal of maintaining at least some profitability in commercial fisheries compels the reevaluation of the traditional freedom of the seas. On 13 April 1976, President Ford signed the Fishery Conservation and Management Act of 1976, which creates a 200-mile U.S. fishery conservation zone as of 1 March 1977; similar inclinations exist in other nations. Other alternatives include private monopolies, limited entry systems, or a single international fisheries corporation. Whatever method is tendered, the traditional rights of fishermen diminish. Whereas the rights of fishermen have been sacred in the past, OSY philosophy requires that this aspect be placed into perspective with other societal criteria.

An additional corollary of OSY deserves separate mention. Throughout the evolution of the discipline, fisheries management has focused almost exclusively on fishing. Some fish species, however, appeal to neither sport nor commercial interest, and some waters, such as high alpine lakes, are naturally fishless. The self-styled mandate of fisheries management has been to stock those barren waters with sport fishes, and to replace nongame species with game species. For example, the typically complete protection afforded the biota and environment in U.S. national parks does not extend to individual fish or to fish faunas (Wallis, 1960). The charter which authorized national parks also authorized angling, and native faunas and naturally fishless waters have been altered in consequence. Even discounting the pressures of modern multiple use, bodies of water and their fish faunas have values separate from fishing. A countercurrent emphasizing values apart from fishing is gaining momentum. The National Park Service has initiated practices to reconstruct native conditions and is currently considering the elimination of fishing. Concern for small and rare fish species is capturing increased attention in both the British Isles (Maitland, 1974) and the United States. One consequence, therefore, of OSY may be the rising importance of fish species analogous to songbirds and wildflowers.

The fact that OSY philosophy cannot pinpoint specific objectives underlies what may be one absolute goal of fisheries management: the maintenance and provision of a broad range of actual and potential opportunities (Wilkins, 1968). The mosaic of criteria relevant to fisheries management and the diverse populace of the United States indicate that massive management programs tailored to one set of needs are inappropriate. An array of opportunities which can accommodate a diversity of interests seems more de-

sirable in terms of limited fisheries resources and growing demands. Urban fishing is an example of a management alternative which had long been ignored despite the increasing urbanization of the U.S. population (McFadden, 1969). While such programs sacrifice many traditional aspects of "quality" fishing, they can accommodate the recreational needs of a large block of people who cannot participate in other fisheries programs.

CONCLUSIONS

Placed within historical perspective, the predominance of MSY as a philosophy seems unequal in kind to either the recognition of exhaustibility or OSY. MSY seems more comparable to the circa 1850 condemnation of trawling as the cause of all decreases in catch per unit of effort. The dominance of MSY has been one step in the recognition of a larger problem. Trawling eventually took its place among destruction of immature fishes by all methods, environmental degradation, and overfishing in general, as complementary forces which eventually proved the exhaustibility of fisheries. Similarly, maximizing physical yield now takes its place among maximizing net economic revenue, maximizing aesthetics, and maximizing total recreational benefits, as complementary criteria which have melded to reflect the desirability of optimizing the overall yield from fisheries resources.

Neither the recognition of exhaustibility nor the philosophy of OSY have been the direct outgrowths of theoretical or scientific analyses. They represent instead the forced acceptance of new ideas when the established ideas collapsed. Inexhaustibility was discarded only when the practical realities of declining catches and declining profitibility in commercial fisheries could no longer be denied. The recognition of OSY is currently being forced on fisheries scientists and administrators by the unwillingness of the remainder of the world to operate according to biological management. One conclusion is therefore rather discouraging: fisheries philosophy has always lagged behind the facts.

Another conclusion, however, is more optimistic. It is naive to suggest that OSY philosophy will easily solve all management problems; if, however, recognizing the problem is indeed half of the solution, OSY philosophy appears to be a significant refinement in management. The formalization of OSY philosophy provides the opportunity for fisheries management to emerge as a distinct discipline. Semantic arguments aside, a fisheries scientist is primarily an investigator of biological, physical, and chemical phenomena within the aquatic ecosystem. Under OSY philosophy, the fisheries manager should emerge as the coordinator and evaluator of knowledge from diverse sources; the input received from fisheries scientists represents just one such source. Other inputs include those from sociologists, economists, politicians, local interest groups, concerned individuals, or any other relevant sources. In this regard, neither biologists nor economists represent the ideal personnel to adequately absorb "secondary" objectives into their respective disciplines and thereby derive programs reflecting OSY. The promise of OSY as a philosophy for fisheries management is that it implies only an approach to problems, not what the solutions ought to be.

ACKNOWLEDGMENTS

The manuscript was reviewed by and has benefitted from the suggestions of William B. Provine, Robert S. Campbell, David L. Johnson, Bruce T. Wilkins, and Sharon K. Nielsen. The manuscript was typed by Alice Klock.

LITERATURE CITED

Ball, O. P., Jr. 1967. Recreational fishery management—A case study of a reservoir. *In* Reservoir fishery resources symposium. Southern Division, p. 453-466. Am. Fish. Soc.

Bell, F. H. 1970. Management of Pacific halibut. *In* N. G. Benson (editor), A century of fisheries in North America, p. 209-221. Am. Fish. Soc. Spec. Publ. 7.

Bell, F. T. 1936. Proposals for the solution of the fisheries conservation problem. Proc. North Am. Wildl. Conf. 1936:201-209

Bertram, J. G. 1873. The harvest of the sea. John Murray, Lond., 340 p.

Blackford, C. M. 1916. The shad—a national problem. Trans. Am. Fish. Soc. 46:5-14.

Borisov, P. G. 1960. Fisheries research in Russia. A historical survey. U.S. Dep. Commer., Off. Tech. Serv., Wash., D.C., 187 p.

Bower, S. 1910. Fishery conservation. Trans. Am. Fish. Soc. 40:95-100.

Christy, F. T., Jr. 1969. Fisheries goals and the rights of property. Trans. Am. Fish. Soc. 98:369-378.

Christy, F. T., Jr., and A. Scott. 1965. The common wealth in ocean fisheries; some problems of growth and economic allocation. Johns Hopkins Press, Inc., Baltimore, 281 p.

Crutchfield, J. A., and G. Pontecorvo. 1969. The Pacific salmon fisheries: A study of irrational conservation. Johns Hopkins Press, Inc., Baltimore, 220 p.

Crutchfield, J., and A. Zellner. 1962. Economic aspects of the Pacific halibut fishery. Fishery Industrial Research 1:1-173.

Cushing, D. H. 1972. A history of some of the international fisheries commissions. Proc. R. Soc. Edinb. Sect. B, Biol. 73:361-390.

Davis, H. S. 1938. Objectives in trout stream management. Trans. Am. Fish. Soc. 68:76-85.

Evans, A. K. 1907. The influence of politics upon the work of the fish culturist, and how fish and game protective associations may assist the latter and the international problem of the proper regulation of the fisheries of the Great Lakes. Trans. Am. Fish. Soc. 36:207-217.

Garstang, W. 1900. The improverishment of the sea. J. Mar. Biol. Assoc. U.K., New Ser. 6:1-69.

Goode, G. B. 1886. The status of the U.S. Fish Commission in 1884. U.S. Comm. Fish and Fisheries, Part 12, Report of Comm. for 1884;1139-1180.

Graham, M. 1943. The fish gate. Faber and Faber, Ltd., Lond., 196 p.

_____. 1956. Concepts of conservation. *In* Papers presented at the International Technical Conference on the Conservation of the Living Resources of the Sea, p. 1-13. United Nations, N.Y.,

Great Britain. 1860. Report on salmon fisheries. Parliament, Parliamentary Papers (Commons), 1860, Reports from Commissioners, Vol. 19.

_____. 1863. Report of the Royal Commission on the operation of acts relating to trawling for herrings on the coasts of Scotland. Parliament, Parliamentary Papers (Commons), 1863, Reports from Commissioners, Vol. 28.

_____. 1866. Report of the commissioners appointed to inquire into the sea fisheries of the United Kingdom. Parliament, Parliamentary Papers (Commons), 1866, Reports from Commissioners, Vol. 17, 18.

Gulland, J. A. 1968. The concept of the maximum sustainable yield, and fishery management. FAO (Food Agric. Organ. U.N.) Fish. Tech. Pap. 70, 30 p.

Hazzard, A. S. 1954. Committee on the North American Fish Policy. Trans. Am. Fish. Soc. 84:377-380.

Hazzard, A. S., and W. Voigt, Jr. 1957. Fish. *In* C. H. Callison (editor), America's natural resources, p. 132-147. Ronald Press Co., N.Y.

Howell, G. C. L. 1921. Ocean research and the great fisheries. Clarendon Press, Oxford, 220 p.

Idyll, C. P. 1966. Coastal and marine waters. *In* H. Clepper (editor), Origins of American conservation, p. 74-89. Ronald Press Co., N.Y.

London International Fisheries Exhibition. 1884. The fisheries exhibition literature. Thirteen volumes. William Clowes and Sons, Ltd., Lond.

Johnstone, J. 1905. British fisheries; their administration and their problems. Williams and Norgate, Lond., 350 p.

Maitland, P. S. 1974. The conservation of

freshwater fishes in the British Isles. Biol. Cons. 6:7-14.
MacKenzie, M. 1860. View of the salmon fishery of Scotland. William Blackwood and Sons, Edinb., 182 p.
McFadden, J. T. 1969. Trends in freshwater sport fisheries of North America. Trans. Am. Fish. Soc. 98:136-150.
McIntosh, W. C. 1899. The resources of the sea. Cambridge Univ. Press, Lond., 248 p.
Mollan, W. K. 1920. The prime essential in commercial fish conservation. Trans. Am. Fish. Soc. 49:72-77.
Nettle, R. 1857. The salmon fisheries of the St. Lawrence. John Lovell, Montreal, 144 p.
Perce, H. W. 1910. Some general remarks on fishing for sport. Trans. Am. Fish. Soc. 40:397-403.
Roedel, P. M. (editor). 1975. Optimum sustainable yield as a concept in fisheries management. Am. Fish. Soc., Spec. Publ. 9, 89 p.
Royce, W. F. 1975. Use of yield models in fishery management. *In* P. Roedel (editor), Optimum sustainable yield as a concept in fisheries management, p. 9-12. Am. Fish. Soc., Spec. Publ. 9.
Russell, E. S. 1942. The overfishing problem. Cambridge Univ. Press, Cambridge, 130 p.
Stroud, R. H. 1966. Lakes, streams, and other inland waters. *In* H. Clepper (editor), Origins of American conservation, p. 57-73. Ronald Press Co., N.Y.
Tomasevich, J. 1943. International agreements on conservation of marine resources, with special reference to the North Pacific. Stanford Univ. Press, Stanford, 297 p.
Wallis, O. L. 1960. Management of sport fishing in national parks. Trans. Am. Fish. Soc. 89:234-238.
Whitaker, H. 1892. Early history of the fisheries of the Great Lakes. Trans. Am. Fish. Soc. 21:163-179.
Wickliff, E. L. 1938. Report of the committee on American fish policy. Trans. Am. Fish. Soc. 68:39-51.
Wilkins, B. T. 1968. An ecological criterion for evaluating an environment. *In* Aspects planning, evaluation & decision-making in sport fishery management, p. 18-3. Cornell Univ., Dep. Conserv., Ext. ser. 1.

MFR Paper 1226. From Marine Fisheries Review, *Vol. 38, No. 12, December 1976. Copies of this paper, in limited numbers, are available from D825, Technical Information Division, Environmental Science Information Center, NOAA, Washington, DC 20235. Copies of* Marine Fisheries Review *are available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402 for $1.10 each.*

MFR PAPER 1227

Foreign Direct Investment in the U.S. Commercial Fisheries Industry

ROBERT A. SIEGEL

ABSTRACT—This report presents an analysis of data on foreign direct investment in the U.S. commercial fisheries industry. The principal data source is the Survey of Foreign Direct Investment in the United States, 1974 *conducted by the Bureau of Economic Analysis, Department of Commerce. At the end of 1974, the total value of foreign direct investment in the U.S. commercial fisheries industry was $129 million. The sources of these investments were: Canada, Denmark, Iceland, Japan, Kuwait, Mexico, Norway, and the United Kingdom.*

Robert A. Siegel is with the Economic and Marketing Research Division, National Marine Fisheries Service, NOAA, 3300 Whitehaven St., N.W., Washington, DC 20019.

INTRODUCTION

This is a report on foreign investment activities in the U.S. commercial fisheries industry. It is associated with a larger study undertaken by the Department of Commerce, Bureau of Economic Analysis (BEA), pursuant to the Foreign Investment Study Act of 1974 (PL 93-479). The principal source of information for this report was the *Survey of Foreign Direct Investment in the United States, 1974*, conducted by BEA. The results of the survey describe the direct foreign investment positions as of 31 December 1974. Other governmental sources are used to supplement the survey data.

INVESTMENT SCOPE

Foreign investment in the U.S. commercial fisheries industry has taken place primarily at the processing and wholesale levels. At the end of 1974, 47 firms reported foreign ownership of 10 percent or more of the voting stock of an incorporated U.S. business enterprise or the equivalent interest in an unincorporated U.S. business enterprise. The total value of this investment was $129 million[1].

Much of the foreign investment in U.S. fisheries is of relatively recent origin. More than half the firms involved received these investments since 1970 (Fig. 1). During 1974 direct investment rose 30 percent to its present level.

[1]Investment is defined as the value of the affiliated foreign groups' direct claims on the assets of their U.S. affiliates, net of claims of the U.S. affiliates on the assets of affiliated foreign groups.

SOURCES AND LOCATIONS OF INVESTMENTS

Over half of the total value of foreign direct investment is from sources in European countries (Fig. 2). A more detailed breakdown indicates that 87 percent originates from only three countries: United Kingdom, Japan, and Canada. The remainder is from investors in Denmark, Iceland, Norway, Kuwait, and Mexico.

The 47 firms operate 107 establishments, which include business offices as well as production facilities. A large number of these establishments are located in the States of Alaska and Washington, but there are also operations in several other states, particularly along the east coast in New York, New Jersey, Massachusetts, and Florida.

About one-third of the establishments are located in Alaska. Disclosure

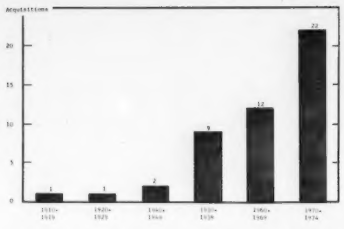


Figure 1.—Number of U.S. companies in the fishing industry in which 10 percent or more of equity has been acquired by foreign investors since 1910.

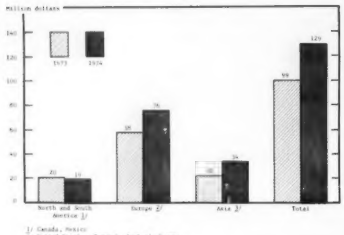


Figure 2.—Value of foreign direct investment in the U.S. commercial fisheries industry by country of foreign investors.

restrictions disallow identification of ownership of these Alaska-based establishments as revealed by the BEA survey. However, according to unclassified information supplied by the U.S. Embassy in Tokyo, the following Japanese trading (T) and fishing (F) firms had investments in Alaskan fisheries enterprises: Mitsubishi (T), Nichiro Gyogyo (F), Taiyo Gyogyo (F), Kyokuyo (F), Marubeni (T), Mitsui (T), and C. Itoh (T). At that time the Embassy reported the largest of these Japanese investments was in Whitney-Fidalgo Seafoods Inc., which operated several processing plants in Alaska. The company reportedly was 98 percent owned by Kyokuyo, a fishing company[2].

Hearings held by the National Marine Fisheries Service in 1974 revealed that the largest known individual foreign investment in the U.S. fishing industry is by a British firm, Hanson Trust, Ltd., which purchased U.S. firms engaged in harvesting and processing menhaden for fishmeal, oil, and other industrial products[3]. Another British firm, the British-American Tobacco Company, is reported to have investment interests in seafood plants located in Alaska, New York, and Washington. Canadian investments are reported in plants in Florida, Maine, and Washington (Bureau of International Commerce, 1973, in press). In addition, a Norwegian company has an investment in a Massachusetts fish processor, and an Icelandic company has investment interests in a plant located in Maryland (Bureau of International Commerce, 1973, in press).

MARKET POSITION

The number of firms in the U.S. commercial fisheries industry with foreign investment has more than doubled in the past 5 years. However, activities of these firms comprise only a minor part of the entire U.S. commercial fisheries industry. In 1974 total sales of these U.S. affiliates of foreign firms were $527 million, of which $235 million were sales by fisheries processing firms and $292 million were by wholesaling firms. Total sales of fisheries products that were processed by all plants in the United States in 1974 were $2.8 billion and sales of U.S. wholesalers of fisheries products were $4.7 billion (National Marine Fisheries Service, 1975). The apparent share of foreign affiliates of each thus was only 8 and 6 percent, respectively.

FINANCING

Investment in U.S. commercial fisheries activities, overall, is predominantly through debt items (e.g. bonds, notes). Foreign parents held $85 million in debt items which represented 66 percent of their total claim on assets (Table 1). The remaining 34 percent was in the form of equity items. The actual value of the equity items was $44 million, of which capital stock and additional-paid-in-capital comprised $39 million, and the rest was retained earnings. Most investments were joint ventures with American firms, establishment of branch offices, or the acquisition of established U.S. companies.

EMPLOYMENT AND PAYROLL

United States affiliates employed 6,462 workers, most of whom were U.S. citizens. Eighty-five percent were production workers. Wages and salaries paid to employees in 1974 totaled $57 million. Data on employment by state or geographical region are not available, nor is it known to what extent U.S. citizens exercise managerial control over those companies.

FOREIGN TRADE

United States fisheries industry affiliates of foreign companies figure heavily in U.S. exports of fishery products. The exports of these firms in 1974 were valued at $72 million, or 28 percent of total U.S. exports of fishery products (Table 2). The corresponding value for imports by these companies was $207 million, or 12 percent of the total value of fishery product imports into the United States. United States affiliates of Japanese and British com-

[2]The size of the "investment" was reported by this source as $11 million, but this may not be comparable to the investments reported in the BEA survey because of possible variance in definitions of investment and possible change in direct investment position over time.

[3]NMFS, Recommended Decision in the Application of Richard Reiss to Transfer Interests in Certain Fishing Vessels and Shipyards to Foreign Ownership (Hanson Trust, Ltd.). April 15, 1974. Hanson reportedly purchased these interests for $32 million.

Table 1.—Components of foreign parents' claim on assets of U.S. affiliates ($1,000), by country, 1974.

Country	Equity items			Debt items	Total claims on assets
	Capital stock	Additional paid-in-capital	Retained earnings		
North & South America (Canada, Mexico)	1,929	27	3,679	13,764	19,399
Europe (Denmark, Iceland, Norway, United Kingdom)	8,208	14,243	-2,550	55,951	75,852
Asia (Japan, Kuwait)	8,322	5,954	4,794	15,120	34,190
Total	18,459	20,224	5,923	84,835	129,441

Table 2.—Value of exports and imports of commercial fisheries products of U.S. affiliates, 1974.

Country	Number of firms	Exports ($1,000)	Percent of exports	Imports ($1,000)	Percent of imports
North & South America (Canada, Mexico)	13	9,127	12.6	67,473	32.6
Europe (Denmark, Iceland, Norway, United Kingdom)	10	30,514	42.2	97,224	46.9
Asia (Japan, Kuwait)	24	32,762	45.2	42,378	20.5
Total	47	72,403	100.0	207,075	100.0

panies were responsible for 84 percent of all affiliates' exports. As a group all affiliates, with the exception of the British, were net importers.

MOTIVATION FOR FISHERIES INVESTMENTS

Motivations of foreign investors can be inferred from particular needs of parent countries, and domestic and international economic conditions. For example, two devaluations of the dollar since December 1971 vis-a-vis currencies of leading industrial nations left Japan, which had previously accumulated large dollar surpluses from trade with the United States, in a more favorable position to invest abroad. Of the 23 investments in the U.S. fishing industry made by Japanese interests, 12 have occurred during the 1970's.

A second reason for foreign investment is a desire to gain a more certain access to additional supplies of fishery products. Both Japan and the United Kingdom appear to share this motive, as evidenced by the fact that both are large exporters of fishery products from their affiliates and the activities of the parent companies from these countries are world wide. Both also depend heavily on seafood as a source of protein, and neither has sufficient resources off its own coast to satisfy this demand. Uncertainties in supply have been heightened by the prospects of coastal nations extending their control of fisheries out to 200 miles. The imminent extension of U.S. jurisdiction to 200 miles probably was a factor in the surge of direct investment in U.S. commercial fisheries in 1974.

Another motive, expansion of market opportunities for products of the parent company, appears to be the underlying reason for foreign direct investment by enterprises of Canada, Iceland, Mexico, and Norway, all of whose U.S. affiliates import considerably more seafood products than they export.

POLICY ASPECTS

The general policy of the United States, with some exceptions, is to admit and treat foreign capital investments on a basis of equality with domestic capital (Council on International Economic Policy, 1974). Federal restrictions on foreign investments relate to certain categories of enterprises which are considered sensitive because of national security significance, involve the exploitation of certain natural resources, or in which special fiduciary responsibilities are involved. The applicable restrictions apply to ownership of enterprises engaging in coastwide or freshwater shipping, domestic radio communications, and domestic air transport.

Under present laws there are no restrictions to foreign capital buying controlling interest in fish-processing or fish-distributing companies in the United States. Aliens also may own controlling interests in domestic corporations operating fishing boats and international shipping lines. However, the transfer of majority ownership of a U.S.-owned company that operates U.S.-documented fishing vessels to a foreign-owned company requires the approval of the Maritime Administration under the provisions of Sections 9 and 37 of the Shipping Act of 1916, as amended.

While foreign investments generally involve processing plants and wholesalers, there were two recent investments that also involved the transfer of U.S.-documented vessels to foreign ownership. The fishing firms involved in these transactions were: Seacoast Products, Inc. (Hanson Trust, Ltd.), which operates in the menhaden fishery in the Gulf and mid-Atlantic, and Whitney-Fidalgo (Kyokuyo), operating primarily in Alaska and Washington.

ACKOWLEDGMENTS

I wish to acknowledge the comments of Phyllis Altrogge and the valuable research assistance of Vito Blomo and Gwenell Bass.

REFERENCES

Bain, J. S. 1968. Industrial organization. John Wiley & Sons, N.Y., 678 p.

Caves, R. E. 1971. International corporations: The industrial economics of foreign investment. Economica 38:1-27.

_____. 1974. Causes of direct investment: Foreign firms shares in Canadian and United Kingdom manufacturing industries. Rev. Econ. Stat. 56:279-293.

Killick, T. 1973. The benefits of foreign direct investment and its alternatives: An empirical exploration. J. Dev. Stud. 9:301-316.

Kindleberger, C. P. 1968. International economics. Richard D. Irwin, Inc., Homewood, Ill., 611 p.

Leftwich, R. B. 1973. Foreign direct investments in the United States, 1962-71. Surv. Curr. Bus. 53(2):29-40.

Litvak, I. A., and C. J. Maule (editors). 1970. Foreign investment: The experience of host countries. Praeger, N.Y., 406 p.

Ragazzi, G. 1973. Theories of the determinants of direct foreign investment. Int. Monetary Fund Staff Pap. 20:471-498.

Richardson, J. D. 1971. Theoretical considerations in the analysis of foreign direct investment. West. Econ. J. 9:87-98.

Safarian, A. E. 1969. The performance of foreign-owned firms in Canada. National Planning Association, Wash., D.C., 123 p.

LITERATURE CITED

Bureau of International Commerce. 1973. Foreign direct investors in the United States. U.S. Dep. Commer., Wash., D.C., 52 p.

_____. In press. Foreign direct investors in the United States. U.S. Dep. Commer., Wash., D.C.

Council on International Economic Policy. 1974. International economic report of the President. Wash., D.C., p. 59-66.

National Marine Fisheries Service. 1975. Fisheries of the United States. Curr. Fish. Stat. 6700, p. 69.

MFR Paper 1227. From Marine Fisheries Review, *Vol. 38, No. 12, December 1976. Copies of this paper, in limited numbers, are available from D825, Technical Information Division, Environmental Science Information Center, NOAA, Washington, DC 20235. Copies of* Marine Fisheries Review *are available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402 for $1.10 each.*

Regional Fishery Management Council Members Named; First National Conference Is Held

Representatives of Federal agencies and members of Congress briefed more than 250 participants on their management roles in the 200-mile fishery conservation zone at a national conference for the Regional Fishery Management Councils in mid-September in Arlington, Va. The meeting was the first for the newly appointed 139 voting and nonvoting members of the eight Councils established under the Fishery Conservation and Management Act of 1976.

Signed on 13 April, that new law established a 200-mile fishery conservation zone off the coasts of the United States and its possessions which will go into effect on 1 March 1977. It also authorized, for the first time in U.S. history, management and conservation of the fish and shellfish in the 200-mile zone, except for tuna, and set up the Councils as the basic management tool for America's fisheries. Regional Councils thus, have the responsibility for developing management plans for the fish stocks within their respective zones.

The Act required the Secretary of Commerce to name a specified number of members to each Council, choosing from lists of qualified individuals recommended by Governors of the States involved. The number of appointed members varies among Councils. All appointments, effective 11 August 1976, were for 1, 2, or 3-year terms. All future appointments will be for 3-year terms.

In addition to the appointed members, the Act required the principal State official with marine fishery management responsibility and expertise in each State, as designated by the respective Governors, and the Regional Director of the National Marine Fisheries Service, a part of the National Oceanic and Atmospheric Administration, for the area to be voting members. Thus, there are 108 voting members.

The Act also requires the Regional or Area Director for the U.S. Fish and Wildlife Service or his designee; the Commander of the Coast Guard District or his designee; and the Executive Director of the Marine Fisheries Commission, if any, or his designee, for the geographical areas of the Councils be nonvoting members. A representative from the State Department is also a nonvoting member of each Council. The eight Councils and their members are listed below.

NEW ENGLAND

The New England Fishery Management Council consists of the States of Maine, New Hampshire, Massachusetts, Rhode Island, and Connecticut. It has 17 voting members, 11 of which are appointed from lists submitted by the respective Governors. Those appointed for 3-year terms were Jacob J. Dykstra, Wakefield, R.I., President, Point Judith Fishermen's Cooperative Association; Erwin H. Jacobs, Stonington, Conn., Noank Marine Exchange; Henry Lyman, Canton, Mass., publisher, "Saltwater Sportsman," Boston; Edward J. MacLeod, Beverly, Mass., General Manager, Lipman Marine Products, Gloucester; and Charles B. Stinson, Prospect Harbor, Maine, President, Stinson Canning Co.

Appointed for 2-year terms were John Burt, New Bedford, Mass., Secretary-Treasurer, New Bedford Fisherman's Union; Virgil J. Norton, Wakefield, R.I., Professor, Department of Resource Economics, University of Rhode Island, Kingston; and Lester B. Orcutt, Biddeford Pool, Maine, commercial fisherman.

Those appointed for 1-year terms were Thomas A. Norris, Milton, Mass., Vice-President, Old Colony Trawler, Boston; Thomas P. Ricci, Coventry, R.I., Barber Auto Sales; and Richard F. Wadleigh, Winnisquam, N.H., Wadleigh Real Estate.

Voting State and Federal Officials on the Council are Frank Grice, Director, Division of Marine Fisheries, Massachusetts; Dennis J. Murphy, Jr., Director, Rhode Island Department of Natural Resources; Lee Wulff, Chairman, New Hampshire Fish and Game Commission; Theodore B. Bampton, Deputy Commissioner, Connecticut Department of Environmental Protection; Vinal O. Look, Commissioner, Maine Department of Marine Resources; and William G. Gordon, Regional Director, National Marine Fisheries Service, Gloucester, Mass.

Nonvoting members are Harry Bishop, Assistant Regional Director, U.S. Fish and Wildlife Service, Boston, Mass.; Vice Admiral W. F. Rea, III, Commander, Atlantic Area, U.S. Coast Guard, Governors Island, N.Y.; Irwin M. Alperin, Executive Director of the Atlantic States Marine Fisheries Commission, Wash., D.C.; and Larry Snead, Office of Deputy Assistant Secretary for Oceans and Fisheries Affairs, State Department.

MID-ATLANTIC

The Mid-Atlantic Fishery Management Council consists of the States of New York, New Jersey, Delaware, Pennsylvania, Maryland, and Virginia. It has 19 voting members, 12 of which were appointed from lists submitted by the respective Governors. Those appointed for 3-year terms were William M. Feinberg, Ocean, N.J., attorney; Allen W. Haynie, Reedville, Va., Chairman, Zapata-Haynie Corporation; John L. McHugh, Stony Brook, N.Y., Professor, Marine Resources, Marine Sciences Research Center, State University of New York, Stony Brook; and Allan J. Ristori, Lodi, N.J., Director of Field Testing, Garcia Corporation, Teaneck.

Those appointed for 2-year terms were Nancy K. Goell, East Hampton, N.Y., Executive Director, Group of America's Sough Fork, Long Island; Elliot J. Goldman, Lafayette Hill, Pa., attorney; William R. Pell, Greenport, N.Y., proprietor, Pell's Fish Market and Sea Food Transportation; and Ricks Savage, Berlin, Md., commercial fisherman.

Those appointed for 1-year terms were John H. Burger, Jr., Dover, Del., President, Burger Construction Co. and Breakwater Construction Co.; Eugene L. Cronin, Annapolis, Md.,

Professor of Zoology, Director of the Natural Resources Institute, University of Maryland; William J. Hargis, Jr., Gloucester Point, Va., Director, Virginia Institute of Marine Sciences; and David H. Hart, Cape May, N.J., marine fisheries consultant.

Voting State and Federal officials on the Council are Peter A. A. Berle, Commissioner, Department of Environmental Conservation, New York; Russel A. Cookingham, Director, Division of Fish, Game and Shell Fisheries, Department of Environmental Protection, New Jersey; Charles A. Lesser, Manager of Fisheries, Delaware Division of Fish and Wildlife, Department of Natural Resources and Environmental Control; Ralph W. Abele, Executive Director, Pennsylvania Fish Commission; Robert J. Rubelmann, Administrator, Fisheries Administration, Maryland; James E. Douglas, Jr., Commissioner, Virginia Marine Resources Commission; and William G. Gordon, Regional Director, National Marine Fisheries Service, Gloucester, Mass.

Nonvoting members are Harry Bishop, Assistant Regional Director, U.S. Fish and Wildlife Service, Boston, Mass.; Vice Admiral W. F. Rea, III, Commander, Atlantic Area, U.S. Coast Guard, Governors Island, N.Y.; Irwin M. Alperin, Executive Director, Atlantic States Marine Fisheries Commission, Wash., D.C.; and Larry Snead, Office of Deputy Assistant Secretary for Oceans and Fisheries Affairs, State Department.

SOUTH ATLANTIC

South Atlantic Fishery Management Council consists of the States of North Carolina, South Carolina, Georgia, and Florida. It has 13 voting members, 8 of which were appointed from lists submitted by the respective Governors.

Those appointed for 3-year terms were Norman B. Angel, New Bern, N.C., Executive Secretary, North Carolina Fisheries Association, Inc.; Allen F. Branch, Midway, Ga., retired; J. Roy Duggan, St. Simon's Island, Ga., President, King Shrimp Co., Inc., Brunswick; and George B. Gross, Maitland, Fla., Corporate Fisheries Advisor, Red Lobster Inns of America, Orlando.

Those appointed for 2-year terms were Gertrude W. Bernhard, Jupiter-Tequesta, Fla., and Benjamin T. Hardesty, Columbia, S.C., Vice-President, Public Relations, Shakespeare Co.

Those appointed for 1-year terms were Edgar C. Glenn, Jr., Beaufort, S.C., retired, and Bruce A. Lentz, Raleigh, N.C., Secretary, North Carolina Department of Administration.

Voting State and Federal officials on the Council are Edward G. McCoy, Director, Division of Marine Fisheries, North Carolina Department of Natural and Economic Resources; Edwin B. Joseph, Director, Marine Resources Division, South Carolina Wildlife and Marine Resources Department; David H. Gould, Supervisor, Coastal Fisheries, Georgia Department of Natural Resources; Harmon W. Shields, Executive Director, Florida Department of Natural Resources; and William H. Stevenson, Regional Director, National Marine Fisheries Service, St. Petersburg, Fla.

Nonvoting members include Robert W. Thoesen, Assistant Regional Director, U.S. Fish and Wildlife Service, Atlanta, Ga.; Rear Admiral R. W. Durfey, Commander, Seventh Coast Guard District, Miami, Fla.; Irwin M. Alperin, Executive Director, Atlantic States Marine Fisheries Commission, Wash., D.C.; and Larry Snead, Office of Deputy Assistant Secretary for Oceans and Fisheries Affairs, State Department.

CARIBBEAN

The Caribbean Fishery Management Council consists of the Virgin Islands and the Commonwealth of Puerto Rico. It has seven voting members, of which four were appointed from lists submitted by the respective Governors.

Those appointed for 3-year terms were Anthony Chioromitaro, Christiansted, St. Croix, V.I., General Manager, Fisherman's Co-op, and Hector M. Vega-Morera, Salinas, P.R., President, Vega's Fishing Co.

Appointment for a 2-year term was Jose A. Suarez-Caabro, Mayaguez, P.R., Coordinator of Fisheries Development, Director of Commercial Fisheries Laboratory, Department of Agriculture for Rhode Island. Appointed for a 1-year term was John A. Harms, Jr., Red Hook, St. Thomas, V.I., President, Lagoon Marina, Inc.

Voting State and Federal officials on the Council are Virdin C. Brown, Commissioner of Conservation and Cultural Affairs, Virgin Islands; Antonio Gonzales-Chapel, Secretary, Department of Agriculture, Commonwealth of Puerto Rico; and William H. Stevenson, Regional Director, National Marine Fisheries Service, St. Petersburg, Fla.

Nonvoting members are Kenneth E. Black, Regional Director, U.S. Fish and Wildlife Service, Atlanta, Ga.; Rear Admiral R. W. Durfey, Commander, Seventh Coast Guard District, Miami, Fla.; and Brian Hallman, Office of Deputy Assistant Secretary for Oceans and Fisheries Affairs, State Department.

GULF OF MEXICO

The Gulf of Mexico Fishery Management Council consists of the States of Texas, Louisiana, Mississippi, Alabama, and Florida. It has 17 voting members, of which 11 were appointed from lists submitted by the respective Governors.

Those appointed for 3-year terms were Theodore B. Ford, III, Baton Rouge, La., Office of Sea Grant Development and Department of Marine Science, Louisiana State University, Center for Wetlands Resources; Robert P. Jones, Tallahassee, Fla., Executive Director, Southeastern Fisheries Association; Charles W. Kraver, Bayou La Batre, Ala., Seafood Haven, Inc.; Robert G. Mauermann, Brownsville, Tex., Executive Director, Texas Shrimp Association and Shrimp Association of the Americas; and John A. Mehos, Galveston, Tex., Vice-President, Liberty Fish and Oyster Company.

Those appointed for 2-year terms were Thomas H. Clark, Orange Beach, Ala., commercial fisherman; Nicolas A. Mavar, Jr., Biloxi, Miss., Secretary/Council, Mavar Shrimp and Oyster Co.; and Edward W. Swindell, Jr., Metairie, La., Wallace Menhaden Products, Inc., New Orleans.

Those appointed for 1-year terms were George A. Brumfield, Moss Point, Miss., Manager, Mississippi Operations, Zapata-Haynie Corp.; John M. Green, Beaumont, Tex., President, E. H. Green Lumber Co.;

and Billy J. Putnam, Panama City, Fla., Bay Point Marina.

Voting State and Federal officials on the Council are James P. Johnson, Attorney at Law, Austin, Tex.; James B. Angelle, Director, Louisiana Wildlife and Fisheries Commission; Charles H. Lyles, Director, Mississippi Marine Conservation Commission; Claude D. Kelley, Commissioner, Alabama Department of Conservation and Natural Resources; Harmon W. Shields, Executive Director, Florida Department of Natural Resources; and William H. Stevenson, Regional Director, National Marine Fisheries Service, St. Petersburg, Fla.

Nonvoting members are Robert W. Thoesen, Assistant Regional Director, U.S. Fish and Wildlife Service, Atlanta, Ga.; Rear Admiral W. W. Barrow, Commander, Eighth Coast Guard District, New Orleans, La.; Joseph V. Colson, Executive Director, Gulf States Marine Fisheries Commission, New Orleans, La.; and Brian Hallman, Office of Deputy Assistant Secretary for Oceans and Fisheries Affairs, State Department.

PACIFIC

The Pacific Fishery Management Council consists of the States of California, Oregon, Washington, and Idaho. It has 13 voting members, 8 of which were appointed from lists submitted by the respective Governors.

Those appointed for 3-year terms were G. A. Hunter, Eureka, Calif., Eureka Fisheries, Inc.; John A. Martinis, Everett, Wash., owner, retail sporting goods store; John W. Mc Kean, Portland, Oreg., retired; and John J. Royal, San Pedro, Calif., Executive Secretary-Treasurer, Fishermen & Allied Workers' Union.

Those appointed for 2-year terms were James A. Crutchfield, Seattle, Wash., Professor, Department of Economics, University of Washington, Seattle, and George J. Easley, Coos Bay, Oreg., commercial fisherman.

Those appointed for 1-year terms were Herman J. McDevitt, Pocatello, Idaho, attorney, and Vernon J. Smith, San Jose, Calif., Electrical Supervisor, Santa Clara County, Calif.

Voting State and Federal officials on the Council are E. Charles Fullerton, Director, Department of Fish and Game, State of California, Resources Agency; John R. Donaldson, Director, Oregon Fish and Wildlife Department; Donald W. Moos, Director, Washington Department of Fisheries; Joseph C. Greenley, Director, Idaho Department of Fish and Game; and Donald R. Johnson, Regional Director, National Marine Fisheries Service, Seattle, Wash.

Nonvoting members include Frederic Vincent, Assistant Regional Director, U.S. Fish and Wildlife Service, Portland, Oreg.; Rear Admiral A. C. Wagner, Commander, Pacific Area, U.S. Coast Guard, San Francisco, Calif.; John P. Harville, Executive Director, Pacific Marine Fisheries Commission, Portland, Oreg.; and Kay Clark-Bourne, Office of Deputy Assistant Secretary for Oceans and Fisheries Affairs, State Department. The Act provides for one additional nonvoting member in the Pacific Council who is appointed by and serves at the pleasure of the Governor of Alaska. He is Charles H. Meacham, Office of the Governor.

NORTH PACIFIC

The North Pacific Fishery Management Council consists of the States of Alaska, Washington, and Oregon. It has 11 voting members, 7 of which were appointed from lists submitted by the respective Governors.

Those appointed for 3-year terms were Douglas B. Eaton, Kodiak, Alaska, commercial fisherman; Donald L. McKernan, Seattle, Wash., Director, Institute for Marine Studies, University of Washington, Seattle; and Elmer Rasmuson, Anchorage, Alaska, retired.

Those appointed for 2-year terms were Harold E. Lokken, Seattle, Wash., Manager, Seattle Fishing Vessel Owners' Association, and Charles H. Meacham, Juneau, Alaska, Director of International Fisheries and External Affairs, Office of the Governor.

Those appointed for 1-year terms were Henry F. Eaton, Kodiak, Alaska, Director, Economic Development, Koniag, Inc., and Clem Tillion, Halibut Cove, Alaska, commercial fisherman.

Voting State and Federal officials on the Council are James W. Brooks, Commissioner, Alaska Department of Fish and Game; Donald W. Moos, Director, Washington Department of Fisheries; John R. Donaldson, Director, Oregon Fish and Wildlife Department; and Harry L. Rietze, Regional Director, National Marine Fisheries Service, Juneau, Alaska.

Nonvoting members are Jan E. Riffe, Assistant Area Director, U.S. Fish and Wildlife Service, Anchorage, Alaska; Rear Admiral J. B. Hayes, Commander, Seventeenth Coast Guard District, Juneau, Alaska; John P. Harville, Executive Director, Pacific Marine Fisheries Commission, Portland, Oreg.; and Lorry Nakatsu, Office of Deputy Assistant Secretary for Oceans and Fisheries Affairs, State Department.

WESTERN PACIFIC

The Western Pacific Fishery Management Council consists of the State of Hawaii, American Samoa, and Guam. It has 11 voting members, 7 of which were appointed from lists submitted by the respective Governors.

Those appointed for 3-year terms were Paul J. Bordallo, Agana, Guam, businessman; Frank K. Goto, Honolulu, Hawaii, Manager, United Fisheries Agency, Ltd., and Peter E. Reid, Pago Pago, American Samoa, Manager, GHC Reid and Company.

Those appointed for 2-year terms were Wadsworth Y. H. Yee, President, Grand Pacific Insurance Company, and Isaac I. Ikehara, Agana, Guam, fishery consultant.

Those appointed for 1-year terms were Louis K. Agard, Jr., Honolulu, Hawaii, commercial fish spotter, and Peter S. Fithian, Honolulu, Director, Greeters of Hawaii, Ltd.

Voting State and Federal officials on the Council are Michio Takata, Director, Division of Fish and Game, Hawaii; Richard C. Wass, Office of Marine Resources, Government of American Samoa; Francisco B. Aguon, Director of Agriculture, Guam; and Gerald V. Howard, Regional Director, National Marine Fisheries Service, Terminal Island, Calif.

Nonvoting members are Eugene Kridler, U.S. Fish and Wildlife Service, Honolulu, Hawaii; Vice Admiral J. W. Moreau, Commander, Fourteenth Coast Guard District, Honolulu, Hawaii; and Lorry Nakatsu, Office of Deputy Assistant Secretary for Oceans and Fisheries Affairs, State Department.

Digitized Nautical Chart Data Readied by NOS

As part of a program by NOAA's National Ocean Survey (NOS) to automate the nautical chart production process, water depths (soundings) and supplemental data from approximately 3,200 survey sheets are being digitized and transferred to magnetic tapes. The National Geophysical and Solar-Terrestrial Data Center (NGSDC) will serve as the agency to make these digitized nautical charting (hydrographic) data available for general use as they are released by NOS, a Commerce Department Agency.

Now available are 166 magnetic tapes representing data from 125 1° × 1° areas off the Atlantic, Gulf, and Pacific coasts of the United States (Fig. 1). The digitized data are from surveys

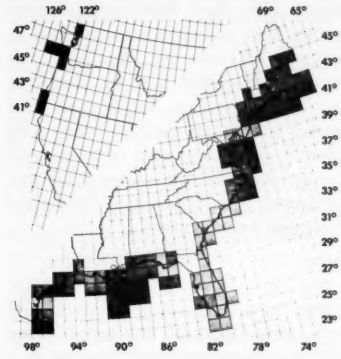


Figure 1.—Index to available hydrographic data.

completed between 1930 and 1965; post-1965 data are to be digitized in the near future. Data from all U.S. coastal waters, including Alaska and Hawaii, will be available within the next several years.

DIGITAL DATA

Most of the data (approximately 97 percent) contained on the magnetic tapes are soundings; the remainder of the data are bottom characteristics (e.g., soft, hard, rock, mud, etc.) and dangers to navigation (e.g., rocks, wrecks, pilings, etc.). All data records contain the registry number of the survey sheet from which they were extracted, the date of completion of the survey, and the latitude and longitude to the nearest 0.01 second. The available data have been digitized from survey sheets of scales 1:2,500 to 1:40,000. Survey scales 1:40,000 to 1:200,000 will be digitized in the near future.

In general, one 1600-BPI tape contains data from one square degree of area; however, in certain cases there are up to eight tapes for one square degree. The master magnetic tapes are 1600 BPI, 9-track, blocked, 5,120 characters per block. The data also can be made available in 9-track (800 BPI) or in 7-track (556 or 800 BPI). More tapes generally will be required for 7-track requests.

ANALOG PRODUCTS

Various plotter products are also available in addition to data on magnetic tape. These include: plots of surroundings, bottom characteristics, dangers to navigation, bottom profile plots, and various statistical plots (e.g., average depth per unit area and depth ranges per unit area).

Owing to the density of data in some inshore areas, plots depicting all soundings as numerals may be restricted to an area of 10-minutes square or less to maintain readability. In these cases soundings may be thinned, if desired, to permit plotting of larger areas without sacrificing readability. Data plots can be prepared to specific scales.

HOW TO ORDER

The data described may be obtained from NGSDC at the following prices. Tapes and documentation cost $60 per tape. For magnetic tapes please specify 9-track (800 or 1600 BPI) or 7-track (556 or 800 BPI) tape density and latitude-longitude limits of the area(s) desired. New plots cost $100 while copies of existing plots cost $20. Plots are limited to a width of 32 inches. There is no limitation on plot length.

Prices for special tape products such as gridded digital data may exceed $60 per tape to cover computer costs. Payment should be made payable to "Commerce/NOAA/NGSDC." Address all orders and inquiries to: National Geophysical and Solar-Terrestrial Data Center, Code D621, EDS/NOAA, Boulder, CO 80302. Their telephone number is (303) 499-1000, ext. 6338; (FTS 323-6338).

Catalogs indicating precise areas and densities of NOS hydrographic data available from NGSDC will be published early in 1977. Until then, consult NGSDC for specific details on any area of interest.

Cape Fur Seal Skin Waiver Extended

Approximately 19,000 Cape fur seal skins can be imported from the Republic of South Africa from the 1976 harvest if that nation meets specific conditions set by the National Marine Fisheries Service, the Commerce Department agency has announced.

The action by Robert W. Schoning, NMFS Director, extends a 1975 waiver to a moratorium placed on imports by the Marine Mammal Protection Act. Under the provisions of the waiver, a limited number of the skins can be imported provided the following conditions are met: 1) The skins must have been taken within the Republic of South Africa, in accordance with its laws, and by, or under, the auspices of that nation; 2) The Republic must certify that none of the skins was taken from Namibia; 3) No more than 70,000 Cape fur seals may be killed in any one year, subject to continuing evaluation of the management program. If more than 70,000 are killed in an annual harvest, no skins from that harvest can be imported into the United States; 4) No skins can be imported from animals that were nursing, pregnant, or less than 8 months old at the time of taking; 5) The skins must be taken in a manner not deemed inhumane by the Director of NMFS; and 6) No skins can be imported for which a required permit has not been issued by the Director of NMFS.

Schoning said that information submitted by the South African government indicated the Republic's inspection program pertaining to humaneness of the Cape fur seal kill has been expanded to include all rookeries. Additional tagging and aerial survey programs have been developed, and, in general, a sound management program consistent with the Marine Mammal Protection Act is continuing to be implemented.

"Because of these conditions," Schoning said, "we find no reason to revoke or amend the waiver." Although the waiver was first granted in March 1976, for skins taken during the 1975 harvest, no skins had been imported by the end of summer.

Gambia Studies Spiny Lobster Decline

The Gambian lobster catch during the 1973-74 season amounted to 65 metric tons (t) worth US$283,000, a significant decline from the record 1965 season when 120 t of lobster were caught. The fishery has recently been the subject of study by the Fisheries Division of the Gambian Ministry of Agriculture and Natural Resource which has become concerned about possible overfishing.

Table 1.—Senegalese lobster canoes operating in Gambia, by fishing centers.

Centers	Year 1974	1972	1966	1962
Brufut	[1] 17	NA	22	NA
Batu Kunku	4	NA	2	NA
Sanyang	9	NA	0	NA
Gunjur	9	NA	5	NA
Kartung	26	NA	8	NA
Total	66	66	37	6

[1]Includes four Gambian canoes.
Source: W. J. Scheffers and N. Hellevang. 1975. Aspects of the Lobster Fishery in The Gambia. Fisheries Publication No. 11, Ministry of Agriculture and Natural Resources, Fisheries Division, Banjul, May 1975, p. 4.

BIOLOGICAL DATA

The spiny lobsters caught by the Senegalese and Gambian fishermen in Gambian waters include: *Panulirus rissoni*, *P. regius*, *Palinurus charlestoni*, and *P. mauritanicus*. Their food consists of fish, other lobsters, shellfish, and dead marine animals. They are bottom dwelling, usually perferring rocky bottoms and coral reefs. *Palinurus mauritanicus*, however, is often found in deep waters where the bottom is sandy or muddy. Spiny lobsters grow fairly slowly, taking about 7 or 8 years to reach maturity but may live 50 years or more.

Table 2.—Gambian lobster fishing data for selected years.

Season[1]	No. of canoes	Total catch (t)	Catch (kg) canoe per night	Price (dalasis/kg)	Total value (dalasis)	Total[2] value (US$)
1961-62	6	50	40	2.50	125,000	70,000
1964-65	37	120	15	2.46	295,000	165,200
1971-72	66	80	5	7.50	600,000	300,000
1973-74	66	65	6.5	7.50	487,500	282,750

[1]The lobster season is from October to June.
[2]Based on the exchange rate effective on 31 December of each season.
Source: Scheffers and Hellevang (Footnote 1, Table 1).

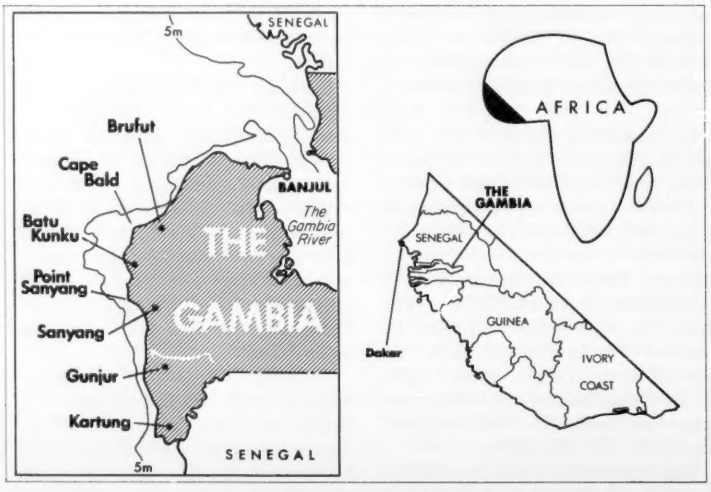


Figure 1.—Gambian lobster fishing centers.

GROUNDS

Lobster is particularly abundant in the areas off Cape Bald and Point Sanyang. In this region there are three important lobster fishing centers: Brufut, Batu Kunku, and Sanyang. Other important villages to the south are Gunjur and Kartung (Fig. 1). It appears that these villages are situated inland, along a highway, rather than directly on the coast.

FLEET FISHING METHODS

Almost all of Gambia's lobsters are harvested by Senegalese fishermen who operate more than 60 canoes, some motorized, from five fishing centers in Gambia (Table 1). Gill nets are used to harvest the lobster in shallow waters up to 5 meters deep. Because the lobsters are more active at night, fishing operations take place mainly after dark. Each canoe carries between six and eight men and sets as many as 100 nets per trip. After the lobsters are landed, they are kept alive in floating wooden crates near the shore until they can be sold. The lobster season begins in October with the arrival of the Senegalese fishermen and extends until the end of June when the rainy season begins.

CATCH

The Gambian lobster catch has declined since 1965 when an estimated 120 t of lobsters were harvested (Table 2). An elevenfold increase in the number of canoes in the lobster fishery between 1962 and 1974 has been accompanied by a decline in the catch per canoe from 40 kg per night to only 6.5 kg (Table 2). The increase in lobster prices, however, has resulted in an increase in the value of the Gambian lobster catch even though the quantity caught and yield per vessel have declined. Gambian officials report, however, that reliable data is difficult to obtain from the Gambian and Senegalese traders who market lobster. Therefore the data in Table 2 must be treated with some caution.

MARKETING

Most of the lobster caught by the artisanal fishermen is collected by a vessel operating from Dakar, Senegal, which makes weekly runs supplying the Senegalese fishermen with food, gasoline, and netting materials.

Another part of the catch is bought from the Senegalese fishermen by Gambian traders who sell the lobster to either a Gambian company, Gambia Fisheries Ltd., or directly to Senegalese exporting companies in Dakar. In addition, a small portion is caught by Gambian fishermen, either intentionally, or incidentally with their primary catches of white fish and is sold locally to hotels during the tourist season.

COMPANIES

Domestic and foreign companies have been involved in the catching and marketing of Gambian lobster. In 1966, the Atlantic Marine Company, based in Banjul (Fig. 1) began to exploit the lobster resources. The company's attempt to employ Gambian fishermen failed due to their lack of experience in lobster fishing. Atlantic Marine was forced to recruit 80 Senegalese fishermen who began lobstering with 15 motorized canoes. At first Atlantic Marine exported over half of its products by air to France (via Dakar) as the exports of France's former colonies are exempted from a 25 percent duty levied by the Common Market on lobster imported from nonmember countries. By 1968, most of the company's exports were being shipped to Las Palmas in the Canary Islands. In 1971, the company terminated its lobster operations after undisclosed problems developed with the Gambian Government.

A Senegalese company, Bafa-Adri-Peche, was established in Banjul to market shrimp and lobster in 1972. The company ceased its Gambian operations abruptly in 1973 for unknown reasons. At present, Gambia Fisheries Ltd., local Gambian traders, and the operators of weekly boats, from Dakar are the main marketing outlets for Gambian lobster.

In the past, Gambian lobster has been exported to France, Senegal, and the Canary Islands. United States import statistics indicate that the United States does not import any Gambian lobster, either directly or via Senegal.

GOVERNMENT PLANS

Declining catches and the increasing number of canoes engaged in the lobster fishery have motivated the Gambian Government to take greater interest in the rational management of the resource. The Gambian Fisheries Division has suggested several steps to remedy the lack of accurate catch and export data, and to assess stock conditions. First, it recommends that all fishermen involved in the exploitation of Gambian lobster, no matter what their nationality, be required to register with the Gambian government and supply catch and export figures to the Fisheries Division. The collected data could be used to assess the condition of the lobster stocks and provide the basis for the imposition of any necessary regulations to prevent overfishing.

The Gambian Fisheries Division is considering three plans to reorganize the lobster industry. First, Gambia might allow the Senegalese to continue to harvest the lobster, but would impose an export duty on all lobster leaving the country. Second, a Gambian company might be set up to collect the lobster from both Gambian and Senegalese fishermen. A third possibility under consideration would be to train Gambian fishermen to harvest lobster and to supply them with the necessary equipment so that they could gradually take over lobster fishing from the Senegalese.

GIFA Signed by U.S. and Poland

Representatives of the governments of Poland and the United States signed on 2 August 1976 in Warsaw a new agreement relating to Polish fishing off the coasts of the United States. The new agreement will come into force following a review by the appropriate authorities of the two countries. Negotiations on this "governing international fisheries agreement" (GIFA) began in Montreal, Canada, in June 1976 during the Annual Meeting of the International Commission for the Northwest Atlantic Fisheries and were successfully completed on 31 July. The GIFA establishes the arrangements which will govern Polish fishing within 200 miles of the U.S. coast after 1 March 1977.

The U.S.-Poland GIFA was the first bilateral fisheries agreement to be negotiated with a country fishing off the coast of the U.S. since the enactment by U.S. Congress of the Fishery Conservation and Management Act of 1976 (FCMA). (Source: U.S. Embassy, Warsaw.)

Japan Lists 1976 North Pacific, Eastern Bering Sea, Fishing Vessels

The Japanese Fisheries Agency licensed a total of 1,208 fishing vessels to fish in North Pacific and eastern Bering Sea grounds in 1976, according to the NMFS Office of International Fisheries. The largest number of licenses was issued for the North Pacific salmon mothership fleets. Many licenses were also issued to the land-based salmon vessels operating south of lat. 48°N and west of long. 175°W, reflecting the importance of Japan's salmon catch.

A large number of licenses was also issued for the Bering Sea surimi vessels which fish for Alaska pollock. The following table gives a detailed look at Japan's North Pacific effort in 1976, according to statistics on licenses issued by the Japanese government.

Table 1.—Japanese vessels licensed for North Pacific and Bering Sea Fisheries, 1976.

Fishery	Mother-ships	Other vessels	Total
North Pacific independent trawlers	0	42	42
Bering Sea surimi vessels	11	198	209
North Pacific longline gillnet vessels[1]	0	22	22
Hokutensen (North-turned vessels)[2]	0	182	182
Eastern Bering Sea crab vessels[3]	2	12	14
North Pacific salmon mothership fleets[4]	10	332	342
North Pacific pelagic whaling fleet	1	9	10
Snail fishing vessels	0	19	19
Land-based gillnet fishing vessels[4] operating south of 48°N	0	285	285
Land-based gillnet fishing vessels[4] operating south of 45°N	0	83	83
Total	24	1,184	1,208

[1] These gillnet vessels do not fish for salmon; they longline for sablefish which is their most important catch.
[2] Of the 182 Hokutensen, 154 vessels are licensed full-time and the remaining 28 vessels are licensed on a seasonal basis.
[3] In addition to the eastern Bering Sea crab fleets, Japan licenses 31 vessels to fish for tanner crab in the western Bering Sea off the coast of the Soviet Union.
[4] In addition to the North Pacific salmon mothership fleets, Japanese effort for salmon also includes coastal vessels.
Source: American Embassy, Tokyo, 18 March, 18 May, and 10 June 1976.

Faeroe Islands, Guatemala Adopt 200-Mile Limits

Guatemala extended its jurisdiction to 200-nautical miles on 1 July 1976 by creating an Exclusive Economic Zone (EEZ) of 188 nautical miles beyhond its 12-mile territorial sea. The EEZ was established by Law 20-76 which was passed by the Guatemalan Congress on 9 June and signed by President Langerud on 18 June 1976. The law became effective upon publication in the Guatemalan official gazette. The major provisions of the new laws are listed below.

GUATEMALAN PROVISIONS

Article 1 "reiterates" Guatemala's claimed sovereignty over a territorial sea of 12 miles "measured from the respective base lines." No attempt is made to define or locate the base lines.

Article 2 confirms the rights of innocent passage of foreign ships through the territorial sea "in conformity with international law."

Article 3 asserts Guatemalan jurisdiction over "an Exclusive Economic Zone (EEZ) that will extend out to 200 nautical miles measured from the base line" used as a basis for the territorial sea. Guatemalan jurisdiction includes: "rights of sovereignty for the exploration, exploitation, conservation, and administration of renewable and nonrenewable resources; exclusive rights and jurisdiction with respect to the establishment and utilization of artificial islands and analogous installations and structures"; exclusive jurisdiction with respect to other activities aimed at exploration and economic exploitation of the zone, "such as production of energy derived from the water, the currents and the winds, and with respect to scientific research"; environmental jurisdiction, including control and elimination of pollution; and "other rights and obligations that may be derived from jurisdiction over the zone."

Article 4 recognizes within the EEZ the right of all other states to "free navigation and overflight, placement of cables and pipelines—provided always that a representative of the Guatemalan Government participates, and internationally recognized uses of the sea related to navigation and communications."

Article 5 authorizes appropriate Guatemalan agencies to issue "regulations regarding fishing, conservation of the sea, and other pertinent activities, in the territorial sea, the EEZ, the continental shelf (seabed and underground), and in the deep sea (fondos marinos)." Until regulations are issued with regard to the EEZ, laws and regulations now in effect for the territorial sea will be applicable to the EEZ in so far as possible. The Government will negotiate pertinent agreements with neighboring states and will issue permits for fishing "or for any other activity of exploration or exploitation of the territorial sea or EEZ."

Article 7 was amended by the Guatemalan Congress. The original Article 7 requested the executive branch of the Government to seek arrangements with the other Central American countries for the common exercise of the right to fish within the 200-mile zone and to establish limitations on overfishing. Deletion of this language was not discussed in the Guatemalan press and no explanation has been made publicly. The executive branch could still, of course, negotiate fishing agreements with other countries, within or without Central America, and submit them to the Guatemalan Congress as treaties. The amended Article 7 provides that "a qualified officer of the Navy will be included in Guatemalan delegations to (international) conferences that discuss maritime affairs." This has been a longstanding objective of the Navy, which has bitterly complained over its exclusion from formulation of LOS policy.

Article 8 charges the Guatemalan Armed Forces with ensuring respect for "the right of the Republic over its territorial sea and its EEZ."

LIKE MEXICO'S EEZ

The Congressional committee which prepared a report on this measure specifically rejected the Chile-Peru-Ecuador thesis of a 200-mile territorial sea, "as it would be unrealistic and practically impossible to exercise full sovereign rights in so extensive an area." The Guatemalan law is similar to Mexico's Constitutional Amendment establishing a 200 mile EEZ. The committee's report placed great emphasis on the rich fishing reserves within 200 miles of the Guatemalan coast, from which Guatemala receives limited benefit and which are "exploited by countries such as Japan, the United States, Canada, the Soviet Union, etc." In addition, the committee report mentions tuna, which suggests that the new law may be applied to highly migratory species.

The law entered into force on 1 July 1976 when it was published in Guatemala's official gazette. (Source: U. S. Embassy, Guatemala City.)

FAEROE ISLANDS

The Faeroe Islands Parliament, the Lagting, unanimously adopted a proposal on 6 August that the Government extend their fisheries jurisdiction to 200 miles, no later than 1 January 1977, according to a report in the Danish newspaper *Land og Folk*. The Lagting also urged the Government to begin talks with the Danish Government to abrogate the 1974 fisheries agreement which allows foreign nations to fish off the Faeroese coast. The agreement can be cancelled after a 6-months notice. The contracting states to the agreement are the United Kingdom, Denmark, the Federal Republic of Germany, France, Norway, Belgium, and Poland, and a 6-month notice is necessary for a state to withdraw.

In 1974, the total Faeroese catch was 247,000 metric tons, of which only 26,000 metric tons was landed within 200 miles of the Faeroes. The remainder of the Faeroese catch was caught in the North Sea, and off Iceland, Norway, and Canada. Foreign nations caught 101,000 metric tons of fish within 200 miles of the Faeroes.

Greenland, another Danish territory, has also requested an extension of its fisheries jurisdiction. In November 1975, the Executive Committee of the Greenland Council demanded a fisheries limit of 100 miles. The Danes themselves stand to gain little from a 200-mile fisheries limit, as they would have to divide the resources of the Skaggerak and Kattegat Straits with Norway and Sweden, and those of the North Sea with other Common Market members. (Source: U.S. Embassy, Copenhagen.)

Sri Lanka Plans Fishing Fleet Expansion

Sri Lanka's Ministry of Fisheries plans to acquire an additional ten small (38 to 60 GRT) trawlers during 1976. The Asian Development Bank (ADB) will finance the project, which is part of a large-scale fisheries development plan.

Currently, 230 GRP (glass reinforced plastic) fishing vessels are being built with ADB financial assistance at three shipyards in Sri Lanka and one shipyard in India. Sri Lankan yards are constructing 200 of the 230 vessels, and these 200 will be 3.5 GRT 28-foot boats for use in the coastal fisheries of the island nation. The Indian shipyard is building 30 larger vessels for the use of fishery cooperatives on Sri Lanka's west coast intending to fish in waters further offshore.

Sri Lanka's fisheries development plan aims at increasing deepwater catches, providing additional employment in boatbuilding and fishing industries, and at raising the level of efficiency of the fishing fleet. The young graduates of fishery training schools at Negombo, Tangalle, Jaffna, and Batticaloa will be employed on the new vessels to demonstrate the merits of modern fishing methods. (Source: *Fishing News International.*)

Sri Lanka's 1973 landings totalled 99,116 metric tons, more than 90 percent of which was taken by coastal fishermen (Table 1), according to the NMFS Office of International Fisheries.

To promote fisheries development, the Government reorganized fishery cooperatives in 1970. By December 1973, 44 of the planned 45 primary fishery co-ops were functioning. The 3.5-ton GRP fishing vessels were sold to fishery co-ops by the Fisheries Department for half of their construction cost. The co-ops pay the Fisheries Department in installments by delivering 25 percent of their daily catches.

Sri Lanka's mechanized fishing fleet at the end of 1973 numbered about 6,300 registered vessels. Of these, 52 percent had a capacity of 3.5 GRT and were either owned by fishery cooperatives or by private individuals (Table 2).

Sri Lanka has received fisheries aid from various international organizations including the United Nations Development Program (UNDP) and the ADB. In addition, bilateral fisheries aid from Japan consisting of fishermen's training and exploratory fishing has contributed to the development of Sri Lanka's fisheries.

In 1962, Sri Lanka initiated a fisheries training center at Negombo. The Government of Japan provided equipment and experts to teach courses in fishing and mechanics. This initial program at Negombo became the nucleus for three additional training centers located in Tangalle, Jaffna, and Batticaloa.

In 1973 the UNDP Skipjack Survey Project was managed by T. Ochi of Japan. In addition to a survey vessel constructed in Sri Lanka, a Japanese pole and line skipjack fishing vessel was chartered for survey work. Nichiro, a major Japanese fishing company, independently carried on experimental skipjack fishing in nearby waters and provided data to the UNDP Skipjack Survey Project.

Recently India and Sri Lanka signed a maritime boundary agreement which established fishing rights in the Palk Straits. (Sources: U. S. Embassy, Colombo; *Administration Report of the Director of Fisheries for the year 1973*, Sri Lanka, 1976; *Fishing News International.*)

Table 1.—Sri Lankan fishery landings, 1972 and 1973, in metric tons.

Landings	1972	1973
Landings by Ceylon Fisheries Corporation trawlers, 11-ton boats, tuna boats, and private deep-sea vessels	2,517	2,347
Landings by 3.5-ton mechanized coastal vessels	38,642	43,292
Landings by nonmechanized coastal vessels	50,646	46,582
Landings of freshwater fish	8,305	6,895
Total	100,110	99,116

Source: Administration Report of the Director of Fisheries for the year 1973, Sri Lanka, March 1976.

Table 2.—Sri Lanka's registered fishing vessels, 1973.

Type of vessel	No.	No.
Mechanized		6,293
3.5-ton privately owned	1,137	
3.5-ton, hire-purchase vessels (used by fishery co-ops)	2,106	
Nonmechanized		69,339
Total		[1] 75,632

[1]The U.S. Embassy, Colombo, estimates that there are about 17,000 nonmechanized vessels in Sri Lanka. The number given in Table 2 is that of the Department of Fisheries and probably overstates the number now actually operating.
Source: Administration Report of the Director of Fisheries for the year 1973, Sri Lanka, 1976.

New Zealand Details Fisheries Programs

The New Zealand National Party Government, elected in 1975, plans to develop the nation's fisheries and to protect its marine resources, according to a party election manifesto. The programs and plans drawn up concentrate on creating incentives for export development, protecting fishery resources, improving fish harvesting and farming, instituting vessel licensing, and encouraging commercial and biological marine research.

To stimulate production in the fishing industry, the New Zealand Government will extend loans for the construction or purchase of vessels, will make certain categories of gear and equipment tax deductible, and will review the present refunding of the sales tax. The Government is also considering granting investment allowances for vessel replacement and special depreciation allowances for equipment. The use of export incentives for various species of fish is also being considered.

In anticipation of the 200-mile economic zone and 12-mile territorial sea laws, the Government is encouraging the development of fisheries for export, and is trying to enlarge its present export markets. In addition, the Government will provide facilities for the storage of fish for off-season sale. There will also be increased

cooperation of defense forces and fishery enforcement patrols in order to pre ent foreign fishing in New Zealand waters, and to protect marine resources in waters where such fishing will be allowed. The Government further plans to examine the possibility of initiating licensing of fishing vessels as a means of protecting certain species against overfishing. Financial aid will be provided to local authorities for the construction of wharves, berths, and slipway facilities.

Biological and commercial research aimed at increasing efficiency in the fishing industry will be stressed. The Government will provide the Fishing Industry Board with an annual grant to promote industrial training and the application of research to commercial operations.

The Government will also continue to encourage the development of fish farming, and the use of warm water wastes from power stations. Oyster, mussel, mollusk, and crustacean farming will be promoted. (Source: *Fishing Industry Board Bulletin*, March 1976.)

Germans Fish Hake Off Southern Africa

The largest West German trawler company, Nordsee Deutsche Hochseefischerei of Bremerhaven, sent two factory trawlers, (2,557 GRT each) to waters off southwestern Africa in late 1975 to catch and process cape hake (*Merluccius capensis* and *M. paradoxus*). The venture was precipitated by the reduction of Germany's catch quotas by the International Commission for the Northwest Atlantic Fisheries (ICNAF) and the recent prohibition on the use of factory trawlers within Iceland's 200-mile fishing zone. Nordsee expected to catch about 12,000 metric tons[1] of hake in 1976. This would represent a sizeable catch increase as the total German hake catch in 1974 was only 233 metric tons (Table 1).

The two stern trawlers were modernized at a cost of about $2.2 million each. The modernization included the installation of twin-net trawling gear, closed-circuit television to monitor fishing operations, and filleting and freezing machinery. According to Marx-Henning Rehder, president of Nordsee, the quality of the frozen hake produced aboard his company's trawlers has been markedly better than that of frozen hake produced by onshore plants. Per-pound returns from the trawler-processed frozen hake have been significantly higher than from hake processed by onshore plants. The frozen hake is transshipped in Walvis Bay from the factory trawlers to freezer carriers and transported back to German ports.

The operation as a whole has not been profitable even though yields per pound have been high. Apart from the high costs of provisioning and servicing ships in such distant waters, the deficit has been due principally to lower-than-anticipated catches during the first 6 months of the operation (late 1975 to mid-1976). Nordsee has learned that the hake catches of other nations' trawlers have also fallen short of expectations, but company officials maintain that the lower-than-anticipated yields are not an indication of overfishing. In Rehder's judgment there is simply not enough scientific data about hake off southern Africa to warrant such a conclusion. It should be noted that hake catches off southern Africa have declined significantly since 1972, however, not below 1970-71 levels (Table 2).

Despite the financial losses incurred thus far, Nordsee has no intention of ceasing operations. Rehder stated that continuous operations of at least 1 year would be required to determine definitively the economics of hake fishing off southwestern Africa. On the other hand, even if the venture becomes profitable, Rehder does not see any likelihood of a significantly expanded effort. Influencing his judgment are: 1) the possibility that hake stocks are more limited than expected; 2) the comparatively high costs and risks of a distant water operation; and 3) the relatively low current level of demand for frozen hake. In addition, there is the uncertainty of fishing within 200 miles of the coast as a possibility that South Africa may establish a 200-mile economic zone and restrict foreign fishing operations cannot be ruled out. Rehder hopes that in such an event his firm would receive quota allocations which would enable Nordsee to continue its present operation. (Source: U. S. Consulate General, Bremen.)

According to the NMFS Office of International Fisheries, the Nordsee operations will substantially increase the Federal Republic of Germany (FRG) hake catch. The FRG reported a record catch of 4,100 metric tons in 1972 when 3,900 metric tons of Patagonian hake was caught off the Atlantic

Table 1.—German (FRG) hake catch, 1970-75.

Year	Catch[1] by species[2]			Total catch
	European	Cape	Patagonian	
1970	200	400	—	600
1971	100	—	—	100
1972	200	—	3,900	4,100
1973	100	1,400	—	1,500
1974	233	—	—	233
1975	NA	NA	NA	NA

[1]Catch is given in metric tons round weight.
[2]Does not include German whiting (*Merlangius merlangus*) or white hake (*Urophycis tenuis*).
Source: FAO Yearbook of Fishery Statistics, 1974, and U.S. Department of Commerce, Bureau of the Census.

Table 2.—Cape hake catch in metric tons off southern Africa, by country, 1970-75.

Country	1975	1974	1973	1972	1971	1970
Bulgaria	NA	10,800	17,400	19,300	20,400	27,400
Cuba	NA	20,500	24,300	48,000	38,300	14,300
Germany (FRG)	NA	—	1,400	—	—	400
Ghana	NA	11,163	4,900	1,100	—	—
Israel	NA	5,575	6,300	9,100	8,500	5,800
Japan	NA	61,567	66,500	54,700	62,900	57,100
Poland	NA	32,341	36,900	3,100	—	—
Portugal	NA	13,510	21,200	13,100	18,700	18,400
Romania	NA	—	—	—	1,000	1,200
S. Africa	[1]113,000	134,870	133,000	118,100	111,500	96,000
Spain	NA	176,600	176,600	186,400	199,600	195,600
USSR	NA	298,408	398,300	655,600	334,600	340,600
Zaire	NA	[2]2,800	[2]2,800	[2]2,800	2,800	5,100
Total	NA	[2]768,134	[2]889,600	[2]1,111,300	798,300	761,900

[1]U.S. Consulate General, Cape Town.
[2]FAO estimate.
Source: FAO Yearbook of Fishery Statistics, 1974.

[1]Approximately 4,000 metric tons of frozen fillets.

coast of South America. Since 1972, the FRG hake catch has declined even though a catch of 1,400 metric tons of cape hake off southern Africa was reported for 1973. U. S. statistics do not list hake imports separately from other species, so it is impossible to determine the quantity of FRG-caught hake exported to the United States.

Thirteen countries fish hake off southern Africa. Only the Romanians, who have not operated there since 1971, had reported smaller catches than the Germans. Almost 770,000 metric tons of hake were caught in 1974, a decline of 31 percent from the 1.1 million metric tons caught in 1972. The Soviet Union, Spain, and South Africa all reported catches in excess of 100,000 metric tons in 1974 (Table 2).

Sweden's 1975 Fish Take Stable, Value Declines

Swedish fishery landings in 1975 were 196,000 metric tons, approximately the same as in 1974. The total 1975 round-weight catch was estimated at 211,000 metric tons. Value of the landings declined from $59 million in 1974 to $54 million in 1975.

The industry was further affected by rising costs, making 1975 a poor year. The Government paid out more than $2 million in subsidies, in the form of price supports and loans to the fishing industry, and fishermen have requested permanent assistance, similar to that received by Swedish farmers.

In April 1976, 800 fishermen in southeast Sweden went on strike for one week to draw attention to their poor economic situation. Fishermen are also concerned about declining fish stocks in the North and Baltic seas, and the international trend towards extensions of fishery jurisdictions to 200 miles. Preliminary landings are shown in Table 1. Annual fishery catches for the past 16 years are shown in Figure 1. (Source: U.S. Embassy, Stockholm.)

Figure 1.—Sweden's annual fish catch, 1960-74. Source: FAO Yearbook of Fishery Statistics, 1974.

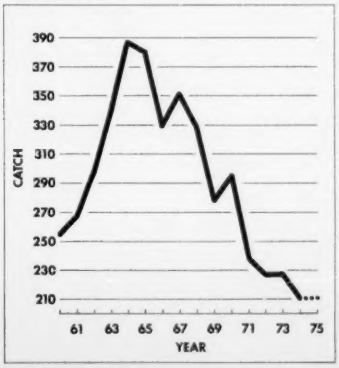


Table 1.—Sweden's preliminary annual fishery landings by species, 1974-75, in metric tons.

Species	1974	1975
Herring (including Baltic herring)	74,976	79,137
Sprat	4,367	3,650
Haddock	2,569	2,624
Cod	19,136	17,965
Mackerel	3,528	4,605
Salmon	578	576
Eel	958	1,273
Fish for reduction	79,696	76,138
Prawns, deep-water	1,865	1,848
Other	8,221	8,273
Total	195,894	196,089
Total value[1]	US$59,394,853	US$54,596,363

[1]Currency conversion rate: US$1.00 = 4.275 Swedish kroner (Skr), 1974; US$1.00 = 4.40 Skr, 1975.
Source: Swedish Central Bureau of Statistics.

Japan, U.S. Discuss Fish Conservation, Management Issues

Bilateral fishery negotiations between Japan and the United States began 18 August 1976, in Washington, D.C. These talks were one of several which have taken place with other governments since the enactment of the Fishery Conservation and Management Act of 1976 (FCMA), the U. S. law which establishes a fishery conservation zone extending out to 200 nautical miles from the U. S. coasts after 1 March 1977. The FCMA established a new system for allowing access to foreign countries which hope to fish off the coasts of the United States, and required each foreign country to sign a "Governing International Fishery Agreement" (GIFA).

One of the conditions for access to fish inside the U. S. 200-mile zone is the acknowledgement by a foreign country of the exclusive management authority of the United States. In addition, no foreign fishing vessels will be allowed to fish inside the 200-mile zone except those licensed by the Secretary of Commerce, or having a valid registration permit issued by the Secretary of State.

The official Japanese position on 200-mile economic zones have been non-recognition of unilateral declarations of extended jurisdiction by coastal states, pending a comprehensive international agreement resulting from the Law of the Sea Conference. Japan's leading business newspaper, *Nihon Keizai Shimbun*, carried a story on 9 August that Japan was prepared to recognize 200-mile economic zones as customary international law. The report was attributed to an anonymous Japanese government official. If this report is true, it would represent a major shift in the Japanese position.

Japan is the world's leading fishing nation based on both the quantity and value of its catch. Japanese vessels catch several important species of fish and shellfish in the North Pacific and eastern Bering Sea including salmon, crab, sablefish, Alaska pollock, rockfish, and other groundfish. Under bilateral agreement with the United States, in 1974 Japan caught approximately 1.4 million metric tons of Alaska pollock, tanner crab, rockfishes, and sablefish in waters within 200 miles of the United States. According to official Japanese government statistics, 4.5 million metric tons of fish and shellfish was caught within 200 miles of foreign countries in 1974. This amount represented 41 percent of Japan's total catch by quantity and about 30 percent of Japan's total catch by value in that year. Japan's total catch in 1974 had a landed value of $5.7 billion. Using these figures, Japan's catch off the United States represented about 13 percent of its total catch by quantity in 1974.

In contrast to the soft-line approach taken by the anonymous Japanese government official quoted on 9 August, the Japanese fishing industry, through the Japan Fisheries Association, has taken a hard line in petitions to the Japanese Government and has submitted a formal representation to the American Embassy in Tokyo.

The Japan Fisheries Association asks that Japan's historical catch levels in the fisheries of the Northeast Pacific be maintained because: 1) Japanese vessels developed the fishery resources, including species still underutilized by the United States, ahead of

other countries; 2) Japan's catch in the Northeast Pacific provides 1.6 million metric tons of food and employs 30,000 crew members and 700 fishing vessels; 3) fish provides more than half the animal protein intake of the Japanese consumer; 4) negotiations with the United States will set a precedent for Japan's negotiations with other coastal nations.

A Japanese press account in the *Suisan Keizai Shimbun* listed the following problems presented by the FCMA to the Japanese industry:

1) The law permits the corporal punishment (i.e. imprisonment) of foreign fisherman convicted of violations of U.S. law

2) It seeks to prohibit fishing for anadromous species (i.e. salmon) outside the 200-mile conservation zone

3) As the licensing procedures and their scheduling and coordination are unclear, it may be technically impossible to administer the law to permit orderly preparations or punctual departures for the fishing grounds

4) Costs of U. S. fishery management and administration of the cumbersome law may be imposed on foreign fishing vessels

5) As ecological and recreational considerations necessary to determination of the "optimum sustainable yield" are vague, they may be abused

6) As criteria for assessing U. S. catch capacity are not stated, they may lead to overestimates

7) No provision for consultations with foreign countries concerning management of anadromous stocks originating outside the United States is made

8) As too much authority is given to the Regional Fishery Management Councils established by the law, meaningful bilateral fishery negotiations will be impossible.

Index

Authors, Titles, Subjects in *Marine Fisheries Review*, Vol. 38, Nos. 1-12, 1976

Indexed here by author, title, and subject are the 54 papers which appeared in *Marine Fisheries Review* in 1976. A list of these papers, in numerical order, appears at the end of the Index. Anonymous notes, news articles, and regular departments are not indexed, since they are often of preliminary or ephemeral nature. Entries are indexed by number and page (i.e., 7:12 indicates the July number, page 12).

A

Alaska
  bowhead whale field studies, 1975, 8:9
Alaska, southeastern
  salmon fishery
    profitability and productivity analysis 4:11
"(An) analysis of increasing costs to Gulf of Mexico shrimp vessel owners: 1971-75," by Wade L. Griffin and John P. Nichols,3:8.
Anodonta californiensis
  polyp, description of in foot, 10:25
Atmospheric gas supersaturation
  Snake and Columbia rivers
    salmon, effect on, 7:1
    steelhead trout, effect on, 7:1

B

Balaena mysticetus—see Whale, bowhead
Barszcz, Carolyn A.—see Yevich and Barszcz
Basham, Larry R.—see Gilbreath et al.
Bass, black sea
  North and South Carolina
    offshore headboat fishing, 1972-73, 3:13
Bering Sea
  bottomfish and herring
    Soviet fisheries off U.S. coast, 12:1
  Japanese trawl vessels
    U.S. observers board 4:1
Bimbo, Anthony—see Dubrow et al.
Blahm, Theodore H., "Effects of water diversions on fishery resources of the west coast, particularly the Pacific Northwest," 11:46
_____ —see Hughes et al.
Bottomfish
  U.S. Pacific and Bering Sea coasts
    Soviet fisheries, 12:1
"Bowhead whale field studies in Alaska, 1975," by Willman M. Marquette, 8:9
Brown, D. J.—see Favorite et al.
Bryan, Patrick G., and Daniel B. McConnell, "Status of giant clam stocks (*Tridacnidae*) on Helen Reef, Palau, western Caroline Islands, April 1975," 4:15

C

California, southern
  marine fisheries
    barracuda, 1:7
    interactions, 1:25
    jack mackerel, 1:15
    northern anchovy, 1:5
    Pacific bonito, 1:11
    Pacific mackerel, 1:16
    Pacific sardine, 1:17
    stock assessment methods, 1:3
    white seabass, 1:18
    yellowtail, 1:22
Cancer magister—see Crab, Dungeness
Caroline Islands, western
  Helen Reef, Palau
    giant clam stocks, status as of April 1975, 4:15
Carroll, Geoffry M., "Utilization of the bowhead whale," 8:18
Cato, James C., "Dockside price analysis in the Florida mullet fishery," 6:4
Centropristis striata—see Bass, black sea
Cerithidea californica
  parasitic encapsulation
    role of agranular hemolymph cells, 10:7
"Chemical characteristics of fish caught in the northeast Pacific Ocean," by Maurice E. Stansby, 9:1
Cheng, Thomas C., "Identification of proliferative lesions in mollusks," 10:5
Clam, giant
  Helen Reef, Palau, western Caroline Islands
    status of stocks, April 1975, 4:15
Clam, soft shell
  neoplasms, gonadal and hematopoietic, 10:42
Clams
  phenol, effects on, 10:10
  proteomyxids
    relation to neoplastic diseases of, 10:16
Clark, Robert C., Jr., "Impact of the transportation of petroleum on the waters of northeastern Pacific Ocean," 11:20
Clemens, Harold B.—see Laurs et al.
"Coho salmon farming in France," by Yves Harache and Anthony J. Novotny, 8:1
Collins, Gerald B., "Effects of dams on Pacific salmon and steelhead trout," 11:39
Columbia River
  atmospheric gas supersaturation, effect on
    salmon, 7:1
    trout, steelhead 7:1
"Comparative retention of dart and jaw tags on chinook salmon and steelhead trout during their spawning migration," by Emil Slatick, 7:24
"Concluding remarks," by Maurice E. Stansby, 11:51
Contaminants—see Pollution
Cooling waters
  aquatic resources of the Pacific Northwest
  impact on
    biological effects, 11:30
    physical effects, 11:29
    sources of cooling water, 11:27
Crab, Dungeness
  escape from pots
    crab recoveries, 4:22
    description of pots, 4:20
    fish captures, 4:23
    mark retention, 4:22
    marking test crabs, 4:20
    octopus predation, 4:22
    pots with tunnel triggers functional and escape rings closed, 4:22
    pots with tunnel triggers functional and escape rings open, 4:21
    pots with tunnels and escape rings open, 4:20
    source of crabs, 4:20
Craddock, Donovan R., "Impact of cooling waters on the aquatic resources of the Pacific Northwest," 11:27
_____ —see Hughes et al.
Crassostrea commercialis—see Oyster, rock
Crassostrea gigas—see Oyster, Pacific
Crassostrea virginica
  hematopoietic neoplasms, occurrence in, 10:34
Crustaceans
  Pacific Ocean, northeast
    chemical characteristics, 9:6

D

"Dermal lesions and amebocytic accumulations in snails," by Charles S. Richards, 10:44
Dermocystidium marinum
  oyster infection
    life cycle, 10:19
    pathology, 10:19

structure, 10:19
taxonomy, 10:19
"*Dermocystidium marinum* infection in oysters," by Frank O. Perkins, 10:19
"Descriptions of polyps and epidermal papillomas in three bivalve mollusk species," by John C. Harshbarger, 10:25
"Distribution, age, and size of tagged adult steelhead trout in the Snake River drainage," by Lyle G. Gilbreath, Larry R. Basham, and Emil Slatick, 6:14
Ditton, Robert B.—see Graefe and Ditton
"Dockside price analysis in the Florida mullet fishery," by James C. Cato, 6:4
Dredging
Pacific Ocean, areas adjacent to northeast
aquatic organisms, effects on, 11:34
Dubrow, David, Malcolm Hale, and Anthony Bimbo, "Seasonal variations in chemical composition and protein quality of menhaden," 9:12

E

Ebel, Wesley J., and Howard L. Raymond, "Effect of atmospheric gas supersaturation on salmon and steelhead trout of the Snake and Columbia rivers," 7:1
Eber, L. E., "Monitoring the ocean environment," 2:1
Ecology data analysis
resource, at Northwest Fisheries Center, 8:22
"Effect of atmospheric gas supersaturation on salmon and steelhead trout of the Snake and Columbia rivers," by Wesley J. Ebel and Howard L. Raymond, 7:1
"Effects of dams on Pacific salmon and steelhead trout," by Gerald B. Collins, 11:39
"Effects of dredging on aquatic organisms—with special application to areas adjacent to the northeastern Pacific Ocean," by George R. Snyder, 11:34
"Effects of phenol on clams," by C. Fries and M. R. Tripp, 10:10
"Effects of water diversions on fishery resources of the west coast, particularly the Pacific Northwest," by Theodore H. Blahm, 11:46
Environmental change
fisheries, northeast Pacific, 11:1
"Environmental change and the northeast Pacific Ocean fisheries: Introductory remarks," by Maurice E. Stansby, 11:1
Epinephelus sp.
North and South Carolina
offshore headboat fishing, 1972-73, 3:13
"Escape of Dungeness crabs from pots," by William L. High 4:19
"(The) evolution of fisheries management philosophy," by Larry A. Nielsen, 12:15

F

Farley, C. Austin, "Proliferative disorders in bivalve mollusks," 10:30
Favorite, F., D.J. Brown, and W. J. Ingraham, Jr., "Resource ecology data analysis at the Northwest Fisheries Center (NWFC)," 8:22
Finfish
Pacific Ocean, northeast
chemical characteristics, 9:6
composition and nutritional properties, 9:11
flatfishes, 9:4
inorganic elements (ash) 9:9
miscellaneous, 9:6
oils, 9:8
proteins, 9:8
proximate composition of fish parts, 9:7
rockfish, 9:5
salmon, 9:4
trace components, 9:10
trash fish, unutilized and miscellaneous, 9:6
trout, 9:4
Fish
coastal pelagic
automated unmanned fishing system to harvest, 2:21
role in meeting world's food needs, 6:1
Fisheries, commercial industry
foreign direct investment in United States
employment and payroll, 12:24
financing, 12:24
foreign trade, 12:24
market position, 12:24
motivation, 12:25
policy aspects, 12:25
scope, 12:23
sources and locations, 12:23
Fisheries, marine
southern California recreational and commercial, 1:1
Fisheries management
evolution of philosophy
biological management for maximum sustainable yield, 12:17
inexhaustibility debate, 12:15
nonbiological criteria, 12:19
optimum sustainable yield, 12:20
Fishery resources
west coast, particularly the Pacific Northwest water diversions, effects on, 11:46
Fishing system
automated and unmanned to harvest coastal pelagic fish
attraction devices, 2:22
benefits, 2:25
concept of operation, 2:23
control techniques, 2:23
present constraints, 2:25
pumping and processing equipment, 2:23
Fishing systems
evaluation using scuba diving methods, 7:15
Flatfish
Pacific Ocean, northeast
chemical characteristics, 9:4
Florida
mullet fishery
dockside price analysis, 6:4
"Foreign direct investment in the U.S. commercial fisheries industry," by Robert A. Siegel, 12:23
France
coho salmon farming, 8:1
French, Robert—see Miller et al.
Frierman, E. Michael, "Occurrence of hematopoietic neoplasms in Virginia oysters (*Crassostrea virginica*)," 10:34
Fries, C., and M. R. Tripp, "Effects of phenol on clams," 10:10

G

"(A) general model for leucocyte cell renewal in bivalve mollusks," by Michael C. Mix, 10:37
"(The) giant Pacific octopus," by William L. High, 9:17
Gilbreath, Lyle G., Larry R. Basham, and Emil Slatick, "Distribution, age, and size of tagged adult steelhead trout in the Snake River drainage," 6:14
"Gonadal and hematopoietic neoplasms in *Mya arenaria*," by Paul P. Yevich and Carolyn A. Barszcz, 10:42
Graefe, Alan R., and Robert B. Ditton, "Recreational shark fishing on the Texas Gulf Coast: An exploratory study of behavior and attitudes," 2:10
Griffin, Wade L., and John P. Nichols, "An analysis of increasing costs to Gulf of Mexico shrimp vessel owners: 1971-75," 3:8
Grouper
North and South Carolina
offshore headboat fishing, 1972-73, 3:13
Gruger, Edward H., Jr.—see Karrick and Gruger
Grunt, white
North and South Carolina
offshore headboat fishing, 1972-73, 3:13
Gulf of Mexico
shrimp vessel owners
increasing costs, 1971-75, 3:8

H

Haemulon plumieri—see Grunt, white
Hale, Malcolm—see Dubrow et al.
Harache, Yves, and Anthony J. Novotny, "Coho salmon farming in France," 8:1
Harshbarger, John C., "Descriptions of polyps and epidermal papillomas in three bivalve mollusk species," 10:25
Herring
U.S. Pacific and Bering Sea coasts
Soviet fisheries, 12:1
High, William L., "Escape of Dungeness crabs from pots," 4:19
_____, "The giant Pacific octopus," 9:17
Hoag, Stephen—see Miller et al.
Hreha, Larry H.—see Laurs et al.
Hughes, John R., Theodore H. Blahm, and Donovan R. Craddock, "A mobile laboratory with flow-through capability for thermal tolerance studies of aquatic organisms," 3:24
Huntsman, Gene, "Offshore headboat fishing in North Carolina and South Carolina," 3:13

I

"Identification of proliferative lesions in mollusks," by Thomas C. Cheng, 10:5
"Impact of cooling waters on the aquatic resources of the Pacific Northwest," by Donovan R. Craddock, 11:27
"Impact of the transportation of petroleum on the waters of the northeastern Pacific Ocean," by Robert C. Clark, Jr., 11:20
"Inflammation and wound repair in oysters," by Albert K. Sparks, 10:2
Ingraham, W. J., Jr. —see Favorite et al.
Invertebrate pathology
comparison with vertebrate pathology, 10:46

J

Japan
trawl vessels in Bering Sea, U.S. observers board
bottomfish fishery, 4:2
incidental catch of crab, 4:7
incidental catch of halibut, 4:6
observer program, 4:4
species composition of catch, 4:9

K

Karrick, Neva L., and Edward H. Gruger, Jr., "Pollution in the northeast Pacific Ocean," 11:2
Kern, Fred G., "*Minchinia nelsoni* (MSX) disease of the American oyster," 10:22

L

Labyrinthomyxa patuxent
proteomyxan amoeba stage in development of, 10:16
Laurs, R. Michael, Harold B. Clemens, and Larry H. Hreha, "Nominal catch-per-unit effort of albacore, *Thunnus alalunga* (Bonnaterre), caught by U.S. jig vessels during 1961-70," 5:1
Lesions
proliferative
identification in mollusks, 10:5
Liao, David S., "Profitability and productivity analysis for the southeastern Alaska salmon fishery," 4:11
Lutjanus buccanella—see Snapper, blackfin
Lutjanus campechanus—see Snapper, red
Lutjanus vivanus—see Snapper, silk

M

MacCall, Alec D., Gary D. Stauffer, and Jean-Paul Troadec, "Southern California recreational and commercial marine fisheries," 1:1
McConnell, Daniel B.—see Bryan and McConnell
Mackin, J. G., and Frank G. Schlicht, "A proteomyxan amoeba stage in the development of *Labyrinthomyxa patuxent* (Hogue) Mackin and Schlicht, with remarks on the relation of the proteomyxids to the neoplastic diseases of oysters and clams," 10:16
Mammals, marine
Pacific Ocean, northeast
chemical characteristics, 9:7
Marquette, William M., "Bowhead whale field studies in Alaska, 1975," 8:9
Menhaden
seasonal variations in
chemical composition, 9:12
protein quality, 9:12
Miller, Mark, Larry Nelson, Robert French, and Stephen Hoag, "U.S. observers board Japanese trawl vessels in Bering Sea," 4:1
Minchinia nelsoni
disease of American oyster, 10:22
"*Minchinia nelsoni* (MSX) disease of the American oyster," by Fred G. Kern, 10:22
Mix, Michael C., "A general model for leucocyte cell renewal in bivalve mollusks," 10:37
_____, "A review of the histopathological effects of ionizing radiation on the Pacific oyster, *Crassostrea gigas*," 10:12
Mobile laboratory
flow-through capability
thermal tolerance studies on aquatic organisms, 3:24

"(A) mobile laboratory with flow-through capability for thermal tolerance studies of aquatic organisms," by John R. Hughes, Theodore H. Blahm, and Donovan R. Craddock, 3:24
Molluscan pathology
workshop, closing comments on, 10:49
Mollusks
epidermal papillomas, description of in three bivalve species, 10:25
lesions, identification of proliferative encapsulation cells, 10:5
phagocytic cells, 10:5
leucocyte cell renewal model for bivalve, 10:34
polyps, description of in three bivalve species, 10:25
proliferative disorders in bivalve, 10:30
Mullet
dockside price analysis in Florida fishery
annual prices, 6:4
industry implications, 6:12
monthly prices, 6:6
price flexibilities, 6:11
Mya arenaria—see Clam, soft shell

N

Nelson, Larry—see Miller et al.
Nichols, John P.—see Griffin and Nichols
Nielsen, Larry A., "The evolution of fisheries management philosophy," 12:15
Nitrite additives
harmful or necessary in foods? 4:24
"Nitrite additives—harmful or necessary?" by Elinor M. Ravesi, 4:24
"Nominal catch-per-unit effort of albacore, *Thunnus alalunga* (Bonnaterre), caught by U.S. jig vessels during 1961-70," by R. Michael Laurs, Harold B. Clemens, and Larry H. Hreha, 5:1
North Carolina
offshore headboat fishing, 1972-73
recreational catches, effort, and angling quality, 3:13
Northwest Fisheries Center
resource ecology data analysis, 8:22
Novotny, Anthony J.— see Harache and Novotny

O

O'Brien, James J.—see Wright et al.
"Occurrence of hematopoietic neoplasms in Virginia oysters (*Crassostrea virginica*)," by E. Michael Frierman, 10:34
Ocean environment
monitoring of
application to fisheries, 2:8
FAX program, 2:3
fishing information, 2:5
ship-of-opportunity program, 2:7
Octopus, Pacific
aggressive behavior exaggerated, 9:18
distribution, 9:17
fast growth-short life, 9:17
fishery, 9:20
handling underwater, 9:19
movements and feeding, 9:18
Octopus dofleini—see Octopus, Pacific
"Offshore headboat fishing in North Carolina and South Carolina," by Gene Huntsman, 3:13
Oil—see Petroleum transportation
Oncorhynchus kisutch—see Salmon, coho
Oregon
coho salmon
monitoring location of, 3:1
Oxygen levels
evaluation of contaminants on marine life, 11:4
Oyster, American
Minchinia nelsoni disease, 10:22
Oyster, Pacific
polyp, description of on mantle, 10:25
radiation, ionizing
histopathological effects on, 10:12
Oyster, rock
epidermal papillomas, description of on mantle, 10:29
Oysters
Dermocystidium marinum infection in, 10:19
hematopoietic neoplasms in Virginia, 10:34
inflammation and wound repair, 10:2
proteomyxids
relation to neoplastic diseases of, 10:16

P

Pacific Northwest
aquatic resources
impact of cooling waters on, 11:27
fishery resources
water diversions, effects of, 11:46
Pacific Ocean
bottomfish and herring
Soviet fisheries off U.S. coast, 12:1
Pacific Ocean, areas adjacent to northeast
aquatic organisms, effects of dredging, 11:34
Pacific Ocean, northeast
chemical characteristics of fish caught in, 9:1
fisheries and environmental change, 11:1, 51
petroleum, impact of transportation, 11:20
pollution, man-caused, 11:2
Pagrus sedecim—see Porgy, red
Papillomas, epidermal
descriptions of in three bivalve mollusk species, 10:25
"Parasitic encapsulation in a marine prosobranch: The role of agranular hemolymph cells," by Timothy P. Yoshino, 10:7
Pathology
vertebrate and invertebrate
observations on comparative, 10:46
Perkins, Frank O., "*Dermocystidium marinum* infection in oysters," 10:19
Petroleum transportation
Pacific Ocean, impact on northeast
biological fate of oil, 11:25
chemical and physical fate of oil, 11:24
crude oil tanker traffic, 11:23
fisheries, direct effects on, 11:25
marine resources, potential effects of oil pollution on, 11:26
oil pollution sources 11:22
Prudhoe Bay crude oil, expected production, 11:20
superports and supertankers, 11:21
transportation and production, 11:20
Phenol
clams, effects on, 10:10
Pollution
Pacific Ocean, areas adjacent to northeast
living resources, impact of material disposal on, 11:36
Pacific Ocean, northeast
contaminants, physical transport and distribution of, 11:6
contamination, toxicology of, 11:6
marine life, effects on, 11:8
marine resources, potential effects of oil pollution on, 11:26
oxygen levels, 11:4
physical environment, 11:4
salinity, 11:5
temperature, 11:5
wastes, domestic, 11:12
wastes, industrial, 11:15
"Pollution in the northeast Pacific Ocean," by Neva L. Karrick and Edward H. Gruger, Jr., 11:2
Polyps
descriptions of in three bivalve mollusk species, 10:25
Porgy, red
North and South Carolina
offshore headboat fishing, 1972-73, 3:13
Pots, crab
Dungeness crab escape from, 4:19
"Profitability and productivity analysis for the southeastern Alaska salmon fishery," by David S. Liao, 4:11
"Proliferative disorders in bivalve mollusks," by C. Austin Farley, 10:30
Prosobranch, marine
Cerithidea californica
role of agranular hemolymph cells in parasitic encapsulation, 10:7
"(A) proteomyxan amoeba stage in the development of *Labyrinthomyxa patuxent* (Hogue) Mackin and Schlicht, with remarks on the relation of the proteomyxids to the neoplastic diseases of oysters and clams," by J. G. Mackin and Frank G. Schlicht, 10:16
Prudhoe Bay crude oil
expected production and transportation, 11:20
Pruter, A. T., "Soviet fisheries for bottomfish and herring off the Pacific and Bering Sea coasts of the United States," 12:1

R

Radiation
ionizing
histopathological effects on *Crassostrea gigas*, 10:12
Radiation energy
seafoods, use in preservation of
dose, measurement of, 6:21
food preservation, 6:22
nature, 6:19
penetration, 6:20
Ravesi, Elinor M., "Nitrite additives—harmful or necessary?" 4:24
Raymond, Howard L.—see Ebel and Raymond
"Resource ecology data analysis at the Northwest Fisheries Center (NWFC)," by F. Favorite, D. J. Brown, and W. J. Ingraham, Jr., 8:22
"(A) review of the histopathological effects of ionizing radiation on the Pacific oyster, *Crassostrea gigas*," by Michael C. Mix, 10:12
Rhomboplites aurorubens—see Snapper, vermillion
Richards, Charles S., "Dermal lesions and amebocytic accumulations in snails," 10:44
Rockfish
Pacific Ocean, northeast
chemical characteristics, 9:5
"(The) role of fish in meeting the world's food needs," by L. J. Ronsivalli, 6:1
Ronsivalli, L. J., "The role of fish in meeting the world's food needs," 6:1
———, "Understanding radiation energy and its use in the preservation of seafoods," 6:19

S

Salinity
evaluation of contaminants on marine life, 11:5
Salmo gairdneri—see Trout, steelhead
Salmon
Pacific Ocean, northeast
chemical characteristics, 9:4
profitability and productivity analysis for Alaska fishery
costs and returns in commercial fishery, 4:12
data sources, 4:11
factors affecting profitability, 4:12
production functions, 4:13
resource productivities, 4:13
vessel characteristics, 4:11
Snake and Columbia rivers
atmospheric gas supersaturation, effect on, 7:1
Salmon, chinook
dart and jaw tags
comparative retention during spawning migration, 7:24
Salmon, coho
farming in France
brood stock development, 8:7
freshwater culture, 8:3
seawater culture, 8:3
monitoring location of harvestable, 3:1
Salmon, Pacific
dams, effects on, 11:39
Scarpelli, Dante G., "The workshop on molluscan pathology: Closing comments," 10:49
Schlicht, Frank G.—see Mackin and Schlicht
Scuba diving
methods for evaluation of fishing systems
diver operations, 7:21
diver safety, 7:21
trawls, dynamically deployed, 7:15
trawls, statically deployed, 7:18
"Scuba diving methods for fishing systems evaluation," by Donald A. Wickham and John W. Watson, Jr., 7:15
Seafoods
radiation energy to preserve, 6:19
"Seasonal variations in chemical composition and protein quality of menhaden," by David Dubrow, Malcolm Hale, and Anthony Bimbo, 9:12

Seidel, Wilber R., and Thomas M. Vanselous, "An automated unmanned fishing system to harvest coastal pelagic fish," 2:21
Shark fishing
behavior and attitudes of recreational fishermen
attitudes and motivations, 2:13
comparison of shark fishers to other fishers, 2:17
fisher characteristics, 2:13
fishing patterns, 2:13
Shellfish
Pacific Ocean, northeast
chemical characteristics, 9:6
Shrimp
Gulf of Mexico
increasing costs of vessel owners, 1971-75, 3:8
Siegel, Robert A., "Foreign direct investment in the U.S. commercial fisheries industry," 12:23
Slatick, Emil, "Comparative retention of dart and jaw tags on chinook salmon and steelhead trout during their spawning migration," 7:24
———, —see Gilbreath et al.
Snails
dermal lesions and amebocytic accumulations, 10:44
Snake River
atmospheric gas supersaturation
effect on salmon, 7:1
effect on trout, steelhead, 7:1
trout, steelhead
distribution, age, and size of tagged adult in drainage, 6:14
Snapper, blackfin
North and South Carolina
offshore headboat fishing, 1972-73, 3:13
Snapper, red
North and South Carolina
offshore headboat fishing, 1972-73, 3:13
Snapper, silk
North and South Carolina
offshore headboat fishing, 1972-73, 3:13
Snapper, vermillion
North and South Carolina
offshore headboat fishing, 1972-73, 3:13
Snyder, George R., "Effects of dredging on aquatic organisms—with special application to areas adjacent the northeastern Pacific Ocean," 11:34
"Some observations on comparative vertebrate and invertebrate pathology: A summary discussion of the workshop," by Harold L. Stewart, 10:46
South Carolina
offshore headboat fishing, 1972-73 recreational catches, effort, and angling quality, 3:13
Soviet fisheries
bottomfish and herring off U.S. Pacific and Bering Sea coasts
data adequacy, 12:8
fishing operations, economics, 12:6
fishing operations, types, 12:3
future, 12:13
historical perspective, 12:1
impact on U.S. fisheries, 12:11
species harvested, 12:8
"Soviet fisheries for bottomfish and herring off the Pacific and Bering Sea coasts of the United States," by A. T. Pruter, 12:1
Sparks, Albert K., "Inflammation and wound repair in oysters," 10:2
SST maps
monitoring the location of harvestable coho salmon, 3:1
Stansby, Maurice E., "Chemical characteristics of fish caught in the northeast Pacific Ocean," 9:1
———, "Concluding remarks," 11:51
———, "Environmental change and the northeast Pacific Ocean fisheries: Introductory remarks," 11:1
"Status of giant clam stocks (*Tridacnidae*) on Helen Reef, Palau, western Caroline Islands, April 1975," by Patrick G. Bryan and Daniel B. McConnell, 4:15
Stauffer, Gary D.—see MacCall et al.
Stewart, Harold L., "Some observations on comparative vertebrate and invertebrate pathology: A summary discussion of the workshop," 10:46
"(A) system for monitoring the location of harvestable coho salmon stocks," by David J. Wright, Bruce M. Woodworth, and James J. O'Brien, 3:1

T

Tags
dart and jaw, comparative retention on
salmon, chinook, 7:24
trout, steelhead, 7:24
Temperature
aquatic laboratory with flow-through capability, 3:24
toxicological impact of a contaminant, 11:5
Temperature—see also SST maps
Texas
Gulf Coast
study of behavior and attitudes of recreational shark fishermen, 2:10
Thunnus alalunga—see Tuna, albacore
Tripp, M. R.—see Fries and Tripp
Troadec, Jean-Paul—see MacCall et al.
Trout
Pacific Ocean, northeast
chemical characteristics, 9:4
Trout, steelhead
dams, effects on, 11:39
dart and jaw tags
comparative retention during spawning migration, 7:24
distribution, age, and size in Snake River drainage
length, 6:16
ocean-age composition, 6:16
tag recoveries, 6:15
timing of recoveries, 6:15
weight, 6:16
Snake and Columbia rivers
atmospheric gas supersaturation, effect on, 7:1
Tuna, albacore
catch-per-unit effort, U.S. jig vessels, 1961-70
annual concentration index, 5:4
annual latitudinal variation in distribution of fishery, 5:3
annual standardized catch-per-unit effort, 5:3
offshore distribution of fishery, 5:4
seasonal development of fishery, 5:4

U

"Understanding radiation energy and its use in the preservation of seafoods," by L. J. Ronsivalli, 6:19
"U.S. observers board Japanese trawl vessels in Bering Sea," by Mark Miller, Larry Nelson, Robert French, and Stephen Hoag, 4:1
United States
commercial fisheries industry
foreign direct investment, 12:23
observers board Japanese trawl vessels in Bering Sea, 4:1
Pacific and Bering Sea coasts
Soviet fisheries for bottomfish and herring, 12:1
"Utilization of the bowhead whale," by Geoffry M. Carroll, 8:18

V

Vanselous, Thomas M.—see Seidel and Vanselous
Vertebrate pathology
comparison with invertebrate pathology, 20:46
Vessels
Japanese trawl
U.S. observers board in Bering Sea, 4:1
offshore headboats, fishing in North and South Carolina, 3:13
shrimp, increasing costs in Gulf of Mexico, 1971-75, 3:8

W

Wastes—see Pollution
Water diversions
west coast, particularly the Pacific Northwest
fishery resources, effects on, 11:46
Watson, John W., Jr.—see Wickham and Watson
West coast
fishery resources
water diversion, effects of, 11:46
Whale, bowhead
Alaska field studies, 1975
autumn whaling, 8:16
migration, 8:15
spring whaling, 8:10
utilization, 8:14
whaling effort, 8:14
whaling methods, 8:12
whaling villages, 8:10
utilization of
animal traps and spears, 8:19
arts and crafts, 8:21
commercial products, 8:18
Eskimo implements, 8:19
food, 8:18
heat, 8:18
light, 8:18
toys, 8:21
Wickham, Donald A., and John W. Watson, Jr., "Scuba diving methods for fishing systems evaluation," 7:15
Woodworth, Bruce M.—see Wright et al.
"(The) workshop on molluscan pathology: Closing comments," by Dante G. Scarpelli, 10:49
Wright, David J., Bruce M. Woodworth, and James J. O'Brien, "A system for monitoring the location of harvestable coho salmon stocks," 3:1

Y

Yevich, Paul P., and Carolyn A. Barszcz, "Gonadal and hematopoietic neoplasms in *Mya arenaria*," 10:42
Yoshino, Timothy P., "Parasitic encapsulation in a marine prosobranch: The role of agranular hemolymph cells," 10:7

Papers in *Marine Fisheries Review*
Vol. 38, Nos. 1-12, 1976

JANUARY

1173. "Southern California recreational and commercial marine fisheries," Alec D. MacCall, Gary D. Stauffer, and Jean-Paul Troadec, 1:1-32.

FEBRUARY

1174. "Monitoring the ocean environment," L. E. Eber, 2:1-9.
1175. "Recreational shark fishing on the Texas Gulf Coast: An exploratory study of behavior and attitudes," Alan R. Graefe and Robert B. Ditton, 2:10-20.
1176. "An automated unmanned fishing system to harvest coastal pelagic fish," Wilber R. Seidel and Thomas M. Vanselous, 2:21-26.

MARCH

1177. "A system for monitoring the location of harvestable coho salmon stocks," David J. Wright, Bruce M. Woodworth, and James J. O'Brien, 3:1-7.
1178. "An analysis of increasing costs to Gulf of Mexico shrimp vessel owners: 1971-75," Wade L. Griffin and John P. Nichols, 3:8-12.
1179. "Offshore headboat fishing in North Carolina and South Carolina," Gene R. Huntsman, 3:13-23.
1180. "A mobile laboratory with flow-through capability for thermal tolerance studies of aquatic organisms," John R. Hughes, Theodore H. Blahm, and Donovan R. Craddock, 3:24-27.

APRIL

1181. "U.S. observers board Japanese trawl vessels in Bering Sea," Mark Miller, Larry Nelson, Robert French, and Stephen Hoag, 4:1-10.
1182. "Profitability and productivity analysis for the southeastern Alaska salmon fishery," David S. Liao, 4:11-14.
1183. "Status of giant clam stocks (*Tridacnidae*) on Helen Reef, Palau, Western Caroline Islands, April 1975," Patrick G. Bryan and Daniel B. McConnell, 4:15-18.
1184. "Escape of Dungeness crabs from pots," William L. High, 4:19-23.
1185. "Nitrite additives—harmful or necessary?" Elinor M. Ravesi, 4:24-30.

MAY

1186. "Nominal catch-per-unit effort of albacore, *Thunnus alalunga* (Bonnaterre), caught by U.S. jig vessels during 1961-70," R. Michael Laurs, Harold B. Clemens, and Larry H. Hreha, 5:1-32.

JUNE

1187. "The role of fish in meeting the world's food needs," L. J. Ronsivalli, 6:1-3.
1188. "Dockside price analysis in the Florida mullet fishery," James C. Cato, 6:4-13.
1189. "Distribution, age, and size of tagged adult steelhead trout in the Snake River drainage," Lyle G. Gilbreath, Larry R. Basham, and Emil Slatick, 6:14-18.
1190. "Understanding radiation energy and its use in the preservation of seafoods," L. J. Ronsivalli, 6:19-24.

JULY

1191. "Effect of atmospheric gas supersaturation on salmon and steelhead trout of the Snake and Columbia Rivers," Wesley J. Ebel and Howard L. Raymond, 7:1-13.
1192. "Scuba diving methods for fishing systems evaluation," Donald A. Wickham and John W. Watson, Jr., 7:14-23.
1193. "Comparative retention of dart and jaw tags on chinook salmon and steelhead trout during their spawning migration," Emil Slatick, 7:24-26.

AUGUST

1194. "Coho salmon farming in France," Yves Harache and Anthony J. Novotny, 8:1-8.
1195. "Bowhead whale field studies in Alaska, 1975," Willman M. Marquette, 8:9-17.
1196. "Utilization of the bowhead whale," Geoffry M. Carroll, 8:18-21.
1197. "Resource ecology data analysis at the Northwest Fisheries Center (NWFC)," F. Favorite, D. J. Brown, and W. J. Ingraham, Jr., 8:22-25.

SEPTEMBER

1198. "Chemical characteristics of fish caught in the northeast Pacific Ocean," Maurice E. Stansby, 9:1-11.
1199. "Seasonal variations in chemical composition and protein quality of menhaden," David Dubrow, Malcolm Hale, and Anthony Bimbo, 9:12-16.
1200. "The giant Pacific octopus," William L. High, 9:17-22.

OCTOBER

1201. "Inflammation and wound repair in oysters," Albert K. Sparks, 10:2-4.
1202. "Identification of proliferative lesions in mollusks," Thomas C. Cheng, 10:5-6.
1203. "Parasitic encapsulation in a marine prosobranch: The role of agranular hemolymph cells," Timothy P. Yoshino, 10:7-9.
1204. "Effect of phenol on clams," C. Fries and M. R. Tripp, 10:10-11.
1205. "A review of the histopathological effects of ionizing radiation on the Pacific oyster, *Crassostrea gigas*," Michael C. Mix, 10:12-15.
1206. "A proteomyxan amoeba stage in the development of *Labyrinthomyxa patuxent* (Hogue) Mackin and Schlicht, with remarks on the relation of the proteomyxids to the neoplastic diseases of oysters and clams," J. G. Mackin and Frank G. Schlicht, 10:16-18.
1207. "*Dermocystidium marinum* infection in oysters," Frank O. Perkins, 10:19-21.
1208. "*Minchinia nelsoni* (MSX) disease of the American oyster," Fred G. Kern, 10:22-24.
1209. "Descriptions of polyps and epidermal papillomas in three bivalve mollusk species," John C. Harshbarger, 10:25-29.
1210. "Proliferative disorders in bivalve mollusks," C. Austin Farley, 10:30-33.
1211. "Occurrence of hematopoietic neoplasms in *Crassostrea virginica*," E. Michael Frierman, 10:34-36.
1212. "A general model for leucocyte cell renewel in bivalve mollusks," Michael C. Mix, 10:37-41.
1213. "Gonadal and hematopoietic neoplasms in *Mya arenaria*," Paul P. Yevich and Carolyn A. Barszcz, 10:42-43.
1214. "Dermal lesions and amebocytic accumulations in snails," Charles S. Richards, 10:44-45.
1215. "Some observations on comparative vertebrate and invertebrate pathology: A summary discussion of the workshop," Harold L. Stewart, 10:46-48.
1216. "The workshop on molluscan pathology: Closing comments," Dante G. Scarpelli, 10:49-50.

NOVEMBER

1217. "Environmental change and the northeast Pacific Ocean fisheries: Introductory remarks," Maurice E. Stansby, 11:1.
1218. "Pollution in the northeast Pacific Ocean," Neva L. Karrick and Edward H. Gruger, Jr., 11:2-19.
1219. "Impact of the transportation of petroleum on the waters of the northeastern Pacific Ocean," Robert C. Clark, Jr., 11:20-26.
1220. "Impact of cooling waters on the aquatic resources of the Pacific Northwest," Donovan R. Craddock, 11:27-33.
1221. "Effects of dredging on aquatic organisms—with special application to areas adjacent to the northeastern Pacific Ocean," George R. Snyder, 11:34-38.
1222. "Effects of dams on Pacific salmon and steelhead trout," Gerald B. Collins, 11:39-46.
1223. "Effects of water diversions on fishery resources on the west coast, particularly the Pacific Northwest," Theodore H. Blahm, 11:47-50.

DECEMBER

1224. "Soviet fisheries for bottomfish and herring off the Pacific and Bering Sea coasts of the United States," A. T. Pruter, 12:1-14.
1225. "The evolution of fisheries management philosophy," Larry A. Nielsen, 12:15-22.
1226. "Foreign direct investment in the U.S. commercial fisheries industry," Robert A. Siegel, 12:23-25.

The National Marine Fisheries Service (NMFS) does not approve, recommend or endorse any proprietary product or proprietary material mentioned in this publication. No reference shall be made to NMFS, or to this publication furnished by NMFS, in any advertising or sales promotion which would indicate or imply that NMFS approves, recommends or endorses any proprietary product or proprietary material mentioned herein, or which has as its purpose an intent to cause directly or indirectly the advertised product to be used or purchased because of this NMFS publication.

☆ GPO 696-341

UNITED STATES
DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL MARINE FISHERIES SERVICE
SCIENTIFIC PUBLICATIONS STAFF
ROOM 450
1107 N.E. 45TH ST.
SEATTLE, WA 98105

OFFICIAL BUSINESS

POSTAGE AND FEES PAID
U.S. DEPARTMENT OF COMMERCE
COM-210

U.S.MAIL

Controlled Circulation Rate

MFR XEROX300XCISSDUE001R 1
XEROX UNIV MICROFILMS
SERIALS DEPT
300 N ZEEB RD
ANN ARBOR MI 48106